

Chapter 28 – Surgery of the Tongue

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Cancer of the tongue principally occurs in middle-aged and elderly males. Most cancers arising on the tongue are squamous cell carcinomas. These lesions tend to be ulcerative and may be either exophytic or infiltrative. The majority of these patients have a history of long-term use of tobacco and alcohol. However, there is a subset of patients who tend to be younger (20 to 40 years of age) who have no known risk factors (Fig. 28-1).[1] Cancer of the tongue in this younger age group can be aggressive and may have a very poor prognosis, despite multimodality therapy. Large size of tumor (T3/T4) of the oral cavity correlates with poor prognosis.[2] Several authors also note that the probability of occult cervical lymph node metastases is high among patients with a cancer of the tongue, even when the tumor is in an early stage (T1/T2).[3] One of the crucial factors in evaluating cancer of the oral tongue is tumor thickness, with increasing rate of metastasis associated with those tumors greater than 4 mm in vertical dimension.[4]

Treatment planning in patients with cancer of the tongue depends, as in other anatomic sites, on the size of the cancer, involvement of the surrounding floor of the mouth or mandible, and the presence or absence of cervical lymph node metastasis. The cancer may be treated either with radiation or surgery, although the latter is nearly universally favored if the primary tumor is resectable.[5] A transoral partial glossectomy provides for adequate margins of resection in most T1/T2 tongue cancers while retaining articulation and swallowing function. Hemiglossectomy or total glossectomy is usually necessary for T3/T4 cancers, in that these tumors usually involve adjacent structures, such as the floor of the mouth, tonsillar pillar, and/or mandible. Cancer involving the mandible itself also requires segmental mandibulectomy for adequate tumor clearance.

Although T1/T2 cancers of the tongue can be controlled by limited surgery with relatively minimal morbidity, subsequent metastases to the neck may lead to the demise of the patient. Even these early stage cancers may be associated with rates of nodal metastasis of 30% or more. Increased locoregional and disease-free survival after elective neck dissection mandate aggressive management of the clinically tumor-negative neck.[3] Thus, a comprehensive approach to controlling regional nodal basin(s) has been adopted over the past 10 to 15 years.

O'Brien and associates[6] developed an excellent comprehensive treatment strategy whose key elements follow:

- Initial radical surgery for the primary cancer
- Preservation of mandibular continuity whenever possible
- Selective or modified neck dissection of levels 1 through 4 for the clinically negative neck, and radical (or modified radical) neck dissection for the clinically positive neck
- Appropriate reconstruction
- Tracheotomy for the more advanced cancers
- Speech and swallowing therapy after treatment
- Postoperative radiation therapy employed selectively for patients with certain clinicopathologic findings, such as the following:
 - T3/T4 primary cancers
 - Positive surgical margins (although these are ideally treated by excision)[*]
 - Poor differentiation
 - Perineural invasion
 - Involvement of multiple nodes
 - Extracapsular spread of nodal disease[*]

These principles apply to carcinoma of the tongue as well as other primary cancers in the oral cavity and oropharynx.

The issue of treatment of the N0 neck in patients with cancer of the tongue has been given a great deal of attention in the literature.[8] Studies comparing survival rates among patients who have undergone elective and therapeutic neck dissections seem to indicate improved survival for those who have undergone elective neck dissection. In addition, more extensive surgical treatment and additional therapeutic modalities may be necessary if disease recurs in the neck when the “wait and see” approach is used.[3] These studies lead to the conclusion that both control of neck metastasis and survival may improve if neck dissection is performed before cervical

metastases become clinically evident. Hence selective neck dissection of levels 1 to 4 in patients with an N0 neck is performed. It is not necessary to dissect level 5, because only rarely does isolated metastasis from the tongue affect this area.^[8]

Likewise dissection of level 2B is not necessary unless metastasis is apparent clinically. This approach can significantly reduce morbidity associated with mobilization and dissection of the accessory nerve. Great care must be taken to include the prevascular and postvascular lymph nodes associated with the facial artery and vein adjacent to the mandible in the dissection. This is a common site of involvement for metastatic cancer of both the lateral tongue and the floor of the mouth. There is a risk of injury to the ramus mandibularis of the facial nerve in dissecting these nodes.

Recently we reported the significant benefit in locoregional control in patients who received elective neck dissection (END) compared with those undergoing a "wait and see" approach of observation.^[3] The poor salvage rate among patients in whom cervical metastasis develops after initial treatment of the primary cancer has been documented.^[3,9] A low salvage rate was seen if treatment of the neck was delayed in patients with T1N0 squamous cell carcinoma of the oral tongue, who developed subsequent cervical metastasis after partial glossectomy. The incidence of occult metastasis for early stage carcinoma of the tongue varies from 20% to 50%, whereas the incidence of salvage in patients in whom the neck is not treated initially ranges between 29% and 50%.^[3] Routine pathologic staging may underestimate micrometastatic deposits.^[10,11]

A major clinical problem encountered is the difficulty in detecting preoperatively occult cervical lymph node metastasis. Palpation alone results in substantial understaging in predicting neck node involvement. Imaging studies, such as computed tomography (CT) and magnetic resonance imaging (MRI) scans, have established criteria for malignancy, including lymph nodes greater than 1 cm in diameter or those with a hypodense center. Combined positron emission tomography (PET) and CT has not significantly improved preoperative prediction of metastatic disease.^[12] However, it is important to remember that 20% of nodes involved by metastatic cancer are less than 1 cm and thus are not detected by palpation or imaging. These nodes may already manifest extracapsular spread. Recent clinical studies are evaluating sentinel lymph node mapping and biopsy to determine sensitivity and specificity for predicting the status of the neck in early cancer of the oral tongue.^[13]

As mentioned, the incidence of cervical lymph node metastasis appears to be related in many cases to size and thickness of the primary tumor, the latter feature measured in a fashion analogous to the Breslow melanoma classification. A significantly decreased risk of cervical metastasis exists when the thickness of the tumor is less than 3 mm.^[4] Furthermore, it is known that larger cancers have a greater tendency to metastasize than smaller ones.



Figure 28-1 Squamous cell carcinoma in a 26-year-old woman with no known risk factors.

PATIENT SELECTION

Patients with biopsy-proven squamous cell carcinoma of the tongue T1/T2 are treated by many surgeons using partial glossectomy with either primary closure or skin graft, depending on the extent of the resection, and extension onto the floor of mouth. Selective neck dissection can be used for neck disease staged as N0 and N1[5,14] and a modified or radical neck dissection in patients whose neck disease is clinically at N2 or greater.

Patients who may be excluded in this comprehensive treatment program are those who

- Refuse surgery
- Are not found to be physically fit
- Have comorbidities and are not expected to survive longer than the near term
- Appear to have early invasive disease, less than 3 mm depth
- Have evidence of distant metastases

PREOPERATIVE PLANNING

A thorough history should be obtained, including details of the patient's consumption of tobacco and alcohol. Many of these patients are alcohol dependent and may be at high risk for development of delirium tremens in the postoperative period. They may also be nutritionally depleted due to dysphasia or pain. The history of referred otalgia is of importance, in that the presence of otalgia may be a sign of perineural and/or deep muscular involvement of the cancer.

The physical examination should evaluate tongue mobility. This can be done simply by asking the patient to protrude the tongue. Deviation of the tongue to the side of the tumor or limitation of mobility of the tongue (Fig. 28-2) indicates deep infiltration of the musculature of the tongue that may be observed even in the presence of a tumor with small surface dimensions. The tumor should also be noted as being endophytic (Fig. 28-3A) or exophytic (see Fig. 28-3B). A greater tendency for metastasis exists in the endophytic, ulcerative, deeply infiltrating tumor than in the superficial, exophytic tumor.



Figure 28-2 Deviation of the tongue due to tumor infiltration.



Figure 28-3 A, Ulcerative endophytic squamous cell carcinoma (SCC). B, Exophytic SCC.

The third dimension must be determined, because both regional recurrence and survivorship have been demonstrated to be related to tumor thickness (>3-4 mm).^[4] Bimanual palpation is extraordinarily important in the evaluation of patients with cancer of the tongue. Gloves should be worn and palpation of the tumor performed to identify deep invasion and estimate the tumor thickness (Fig. 28-4). The surface dimensions of the tumor should be measured to correctly assign it to the proper stage. A complete examination of the oral cavity and indirect laryngoscopy or nasopharyngoscopy should be performed to identify synchronous primary cancers in the upper aerodigestive tract.



Figure 28-4 Palpation of the tongue is important in evaluating the depth of invasion.

The oral cavity examination must include a detailed examination of the condition of the teeth and gums. The patient with diseased residual dentition or in whom advanced periodontal disease is present should have a dental consultation (Fig. 28-5). Restorations can rarely be done before surgery. If the patient is likely to receive postoperative radiation therapy, extractions are done at the time of surgery to prevent osteoradionecrosis. It also prevents unnecessary delay in having the patient's teeth extracted after the extirpative surgery has been carried out and the patient has healed. Furthermore, extraction of the teeth may help in wound healing, because the bacteria count associated with advanced periodontal disease is considerably increased.



Figure 28-5 Cancer of the tongue in a patient with poor dental hygiene.

The neck is palpated to ascertain the presence or absence of cervical lymph node metastasis. Palpable lymph nodes should be measured for assignment of appropriate N stage (Fig. 28-6). Radiographic evaluation is important, and each patient should have a chest radiograph. If dysphagia exceeds that expected based on the tumor extent, barium swallow esophagram may be useful before operative endoscopic visualization to rule out a second primary cancer of the esophagus.



Figure 28-6 Cancer of the tongue (A) with metastasis (B) to the neck.

Imaging of both the tongue and the neck with CT or MRI scanning can be very useful in certain cases, particularly in T3/T4 lesions. Some clinicians advocate determining the depth of invasion and the extent of involvement of the tongue with MRI scanning, which seems to give a more detailed evaluation of infiltration between the muscle fibers (Fig. 28-7). This information may be helpful in treatment planning, especially because it concerns extent of resection, type of reconstruction, and patient counseling. However, this rarely alters treatment modality or extent beyond the use of CT scanning. Co-registered PET-CT may not be cost effective, but occasional distant metastases are identified.



Figure 28-7 Magnetic resonance imaging (MRI) scan of deeply infiltrating squamous cell carcinoma of the tongue.

T1/T2 cancers of the oral cavity that have not previously been biopsied but clearly have the characteristics of squamous cell carcinoma may be treated by excisional biopsy in the form of partial glossectomy rather than subjecting the patient to a punch or incisional biopsy as an outpatient. Frozen sections are carried out and a neck dissection can be performed during the same operation once the diagnosis has been made.

SURGICAL TECHNIQUE

Partial or Hemiglossectomy

Patients with T1, T2, and select T3 lesions may be treated by transoral partial glossectomy. Patients who have a full set of teeth or who have a stocky, muscular configuration of the neck may not be good candidates for extensive transoral surgery because of the difficulty in acquiring adequate exposure. These patients are best approached through a mandibulotomy.

My usual sequence of surgery for patients who will have partial glossectomy and neck dissection is to first perform the excision of the primary cancer using semisterile (clean gloves and gown) procedures and to then sterilely prepare and redrape in order to carry out the neck dissection. This order allows for frozen section margins to be obtained, eliminates a second draping, and permits harvesting of a skin graft or flap precisely suited to the defect created. In addition, the decision whether to place a tracheotomy (for tongue swelling or more commonly if a skin graft and bolster are required) can only be made after the defect is created. The tracheotomy is then performed during the neck dissection, incorporating it into the horizontal limb of the neck incision. Perioperative antibiotics are administered intravenously before the start of the procedure.

The patient is placed under a general anesthetic. If the patient will not receive a tracheostomy, nasal-tracheal intubation is preferred in order to have the endotracheal tube out of the oral cavity, providing better exposure. Direct laryngoscopy and esophagoscopy are carried out at this time, if these procedures have not been carried out previously. If no additional primary cancers are found, the surgical procedure begins. Partial glossectomy may be performed under local anesthesia for poor-risk patients who will not have a neck dissection. Most patients with T1/T2 lesions who are treated by transoral partial glossectomy with the wound closed primarily do not require a tracheostomy. However, if a tracheostomy is required for those with more extensive lesions or those in whom skin grafts will be used for reconstruction, this procedure may be performed during the neck portion of the procedure.

A folded blanket is placed under the patient's shoulders if a neck dissection will be carried out later. The patient's face and neck are then prepared and draped into the operative field. The neck is draped out with a towel stapled to the skin along the mandible and chin. The patient's thigh should also be prepared and draped if there is a possibility that a skin graft will be necessary for reconstruction.

A Jennings mouth gag or dental bite block is used to keep the patient's mouth open during the surgery. Right-angled retractors are used to retract the buccal mucosa for adequate exposure. A 2-0 silk suture is placed 1 cm behind the tip of the tongue in the exact, avascular midline in order to avoid bleeding and to provide for adequate retraction. Additional sutures may be used to provide sequential retraction as the resection is performed. Traction is exerted on the tongue both anteriorly and on the opposite side of the tumor in order to bring the tumor into view (Fig. 28-8). The tumor is inspected and palpated to ascertain the estimated depth of resection. At least 1 cm of normal mucosa on all sides of the tumor is drawn on the tongue (Fig. 28-9) or marked out with the cautery. A 2-0 silk suture is placed in the anterior margin of resection before removing the specimen, because once the tumor is excised orienting the specimen can be difficult. The tumor is excised (Fig. 28-10). Frozen sections are obtained from the resection bed or from edges of the specimen. It is preferable that the pathologist come into the operating room to see the operative site and to receive face-to-face communication regarding orientation of the specimen.



Figure 28-8 The use of a Jennings mouth gag, a right-angled retractor, and a traction suture in the midline of the tongue provides adequate exposure for partial glossectomy.

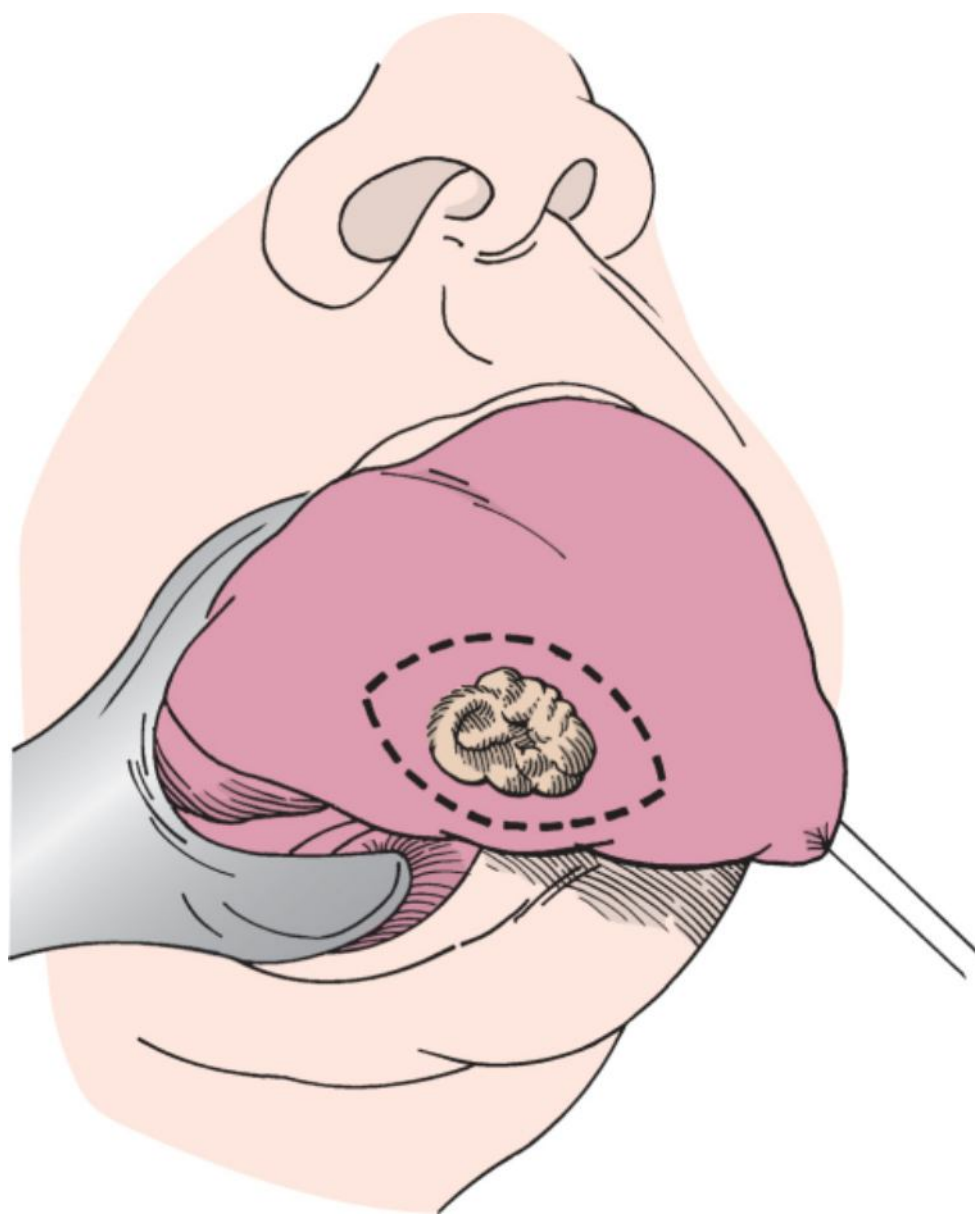


Figure 28-9 The elliptical excision is outlined on the tongue.

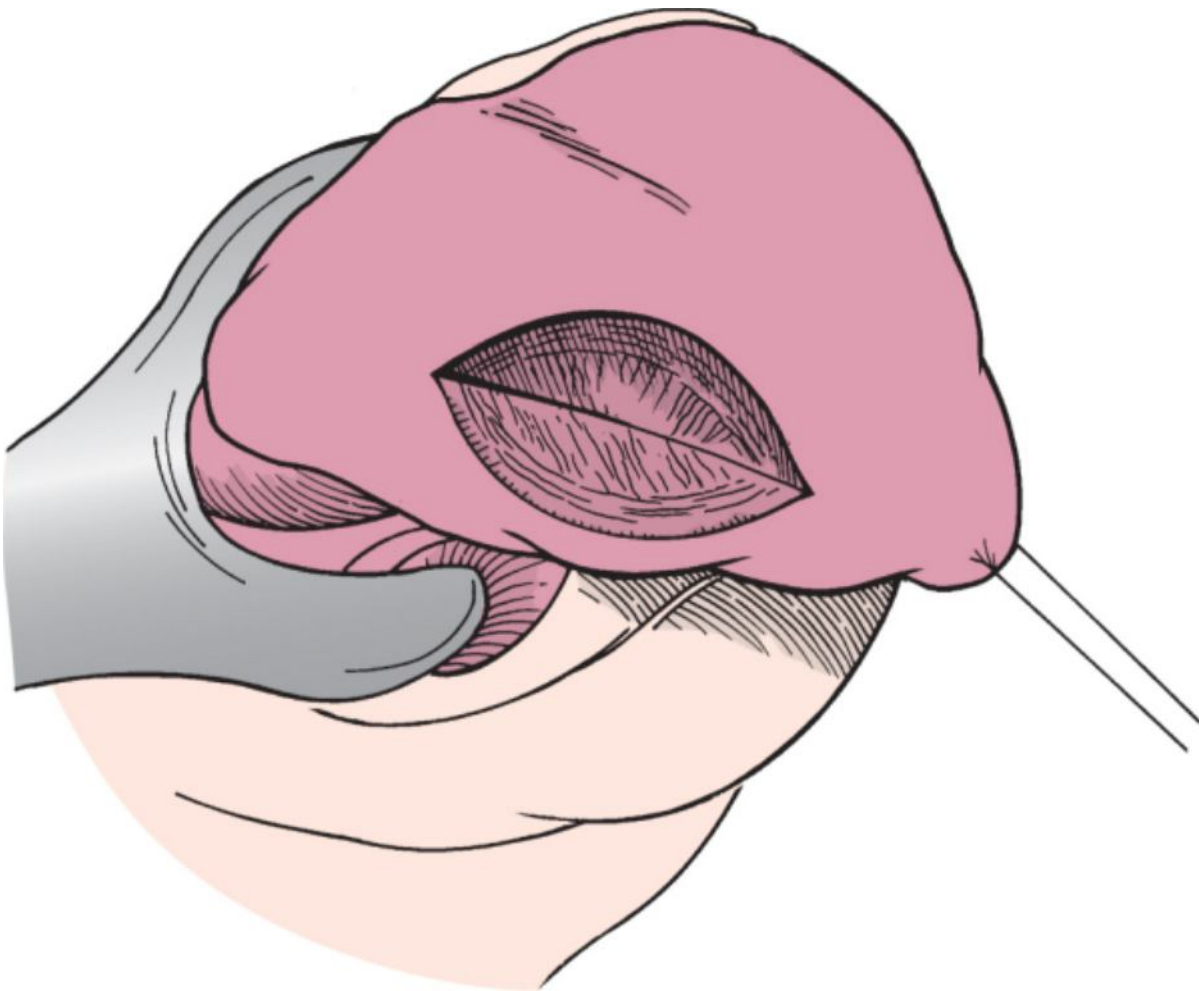


Figure 28-10 The lesion, including muscle, is excised.

Local infiltration anesthesia is not used to avoid distortion of the tongue, unless the procedure is being performed under local rather than general anesthesia. A scalpel or a needle-tipped electrocautery knife is used to make the mucosal incisions. The surface margins of resection are easily seen. The deep margin of resection is usually identified by palpation. A substantial amount of tongue muscle must be taken in order to get an adequate deep margin of resection, particularly in patients who have endophytic types of tumor or in whom perineural involvement is known or suspected.

Branches of the lingual artery are transected during the surgery. If definite branches are identified, they should be clamped and ligated with 2-0 silk suture before their division. After inadvertent transection, this is difficult due to vessel retraction into the tongue musculature. Absolute meticulous hemostasis is very important, particularly if a tracheotomy is not performed, to prevent postoperative edema/hematoma. Hemostasis is obtained by clamping all of the bleeding areas and using figure-of-eight 3-0 chromic catgut sutures. If the resection of musculature is deep, the dead space should be closed using chromic catgut interrupted sutures. If the resection is more superficial, 3-0 Vicryl or silk sutures may be used in a vertical mattress technique, with the deep stitch closing the dead space and the superficial stitch used to approximate and evert the mucosal edges (Fig. 28-11). A nasopharyngeal airway may be used to support the airway in the immediate postoperative period, but if postoperative swelling is anticipated, a tracheotomy should be performed. It is usually not necessary to administer intravenous steroids, because the resection reduces tongue volume.

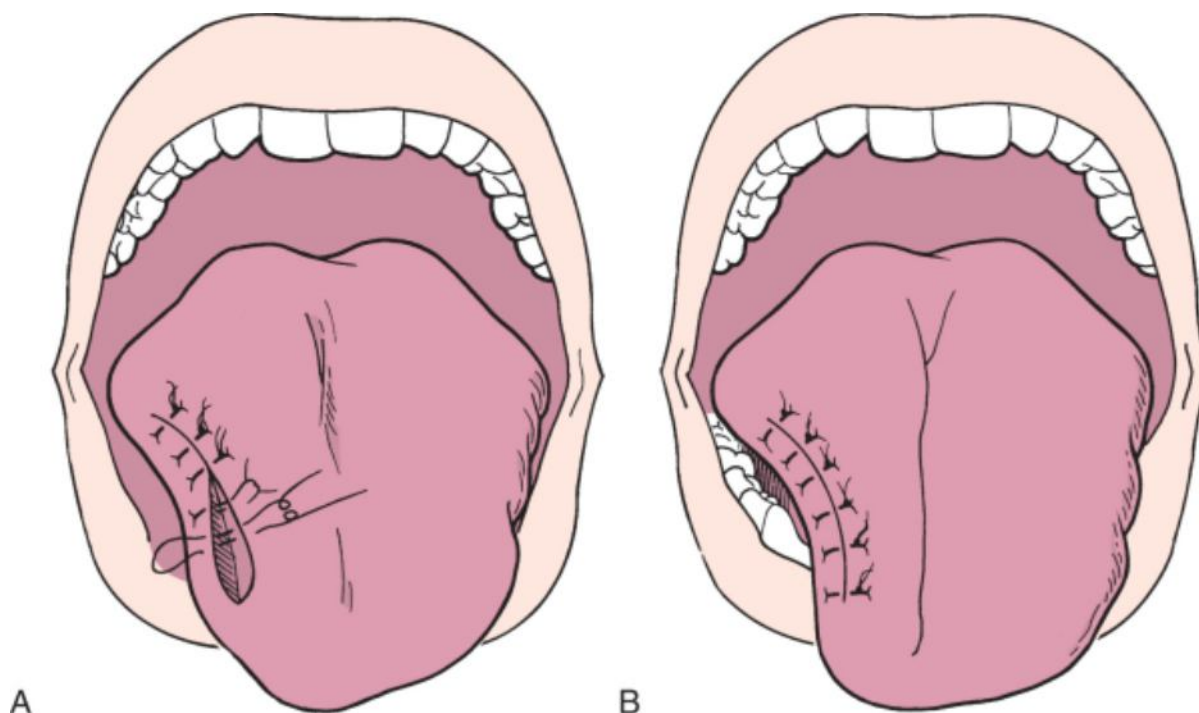


Figure 28-11 A and B, The wound is closed with vertical mattress sutures.

Patients with a more extensive cancer may require a hemiglossectomy, which is carried out in precisely the same way as previously discussed, except the incision is begun at the tip of the tongue in the midline and carried down the median raphe to avoid bleeding. Posterior and lateral incisions are made to accomplish the excision. Frozen section examination of the lesion is carried out to ensure adequacy of resection.

Oral cavity crippling may result from restriction of tongue mobility if the patient has a primary closure of a large wound or one involving significant floor of mouth mucosa. In such situations, a split-thickness skin graft taken from the ipsilateral thigh at 0.016 to 0.018 inches is used to resurface the tongue. After hemostasis is obtained, the skin graft is sewn with a “pie-crusting” technique to the edges of the defect.^[15] This may be done in either an interrupted or a “quilting” technique. During the closure, every other suture is left long in order to tie over the bolus to provide adequate immobilization of the skin graft.^[16] Because there is so much motion of the tongue, it is important to secure the skin graft well. The quilting technique is used, taking multiple sutures through the skin graft into the substance of the muscle of the tongue to secure it to the underlying tissues. A radial forearm free tissue transfer may be more appropriate for a subtotal glossectomy defect because it provides more bulk and pliability.

In addition to the reasons stated, if the oral cavity becomes connected with the neck, this connection may not be noticed at the time of the excision. If the neck dissection had already been completed, it would then be necessary to open the neck again to reconstruct the floor of the mouth to prevent contamination of the neck.

Following completion of the partial glossectomy, the surgeon is regowned and gloved and the patient is prepared and draped for a neck dissection.

Total Glossectomy

Whereas good local control of a small cancer of the tongue may be achieved by either limited resection or radiation therapy, the management of T3/T4 squamous cell carcinoma is more complex. These cancers may arise from the floor of the mouth and infiltrate posteriorly, effectively destroying much of the substance of the tongue, and they may involve the mandible, although they usually spare the larynx. A more difficult cancer to manage is that arising in the base of the tongue. These cancers are usually poorly differentiated, ulcerative, and infiltrative, and they often tend to extend inferiorly toward the hyoid bone and preepiglottic space. In these instances, laryngectomy becomes mandatory even though the larynx is not involved. A larynx-preserving procedure may be feasible, however, when a margin is adequate posterior to the tumor.

PATIENT SELECTION

Properly selected patients can be successfully rehabilitated after total glossectomy without laryngectomy. Successful rehabilitation begins with good patient selection and preoperative preparation. Postoperative rehabilitation requires the interplay of a highly motivated patient and a well-coordinated health care team. The

speech pathologist, maxillofacial prosthodontist, dietitian, and social worker all play important roles in maximizing the postoperative quality of life for the patient. Because many of my patients have been effectively rehabilitated and have returned to a good quality of life, I advocate preserving the larynx whenever possible if the patient must undergo total glossectomy.

PREOPERATIVE PLANNING

Preoperative planning is extremely important in this highly select patient population. Comprehensive planning should include attention to the approaches for extirpation of the primary cancer as well as the accompanying neck dissections and reconstructive procedures.

Imaging is important in formulating a plan of management. I prefer CT to evaluate invasion of the mandible and cervical lymph node metastasis but I have come to rely on MRI for evaluating the extent of local invasion of the cancer. MRI provides more information about infiltration into muscle and fascial planes and helps better evaluate the extent of the lesion and the possibility of laryngeal preservation (Fig. 28-12). Chest radiographs should be obtained to rule out distant metastasis or a second primary tumor. Barium swallow esophagram is important to rule out a second primary tumor in the esophagus.

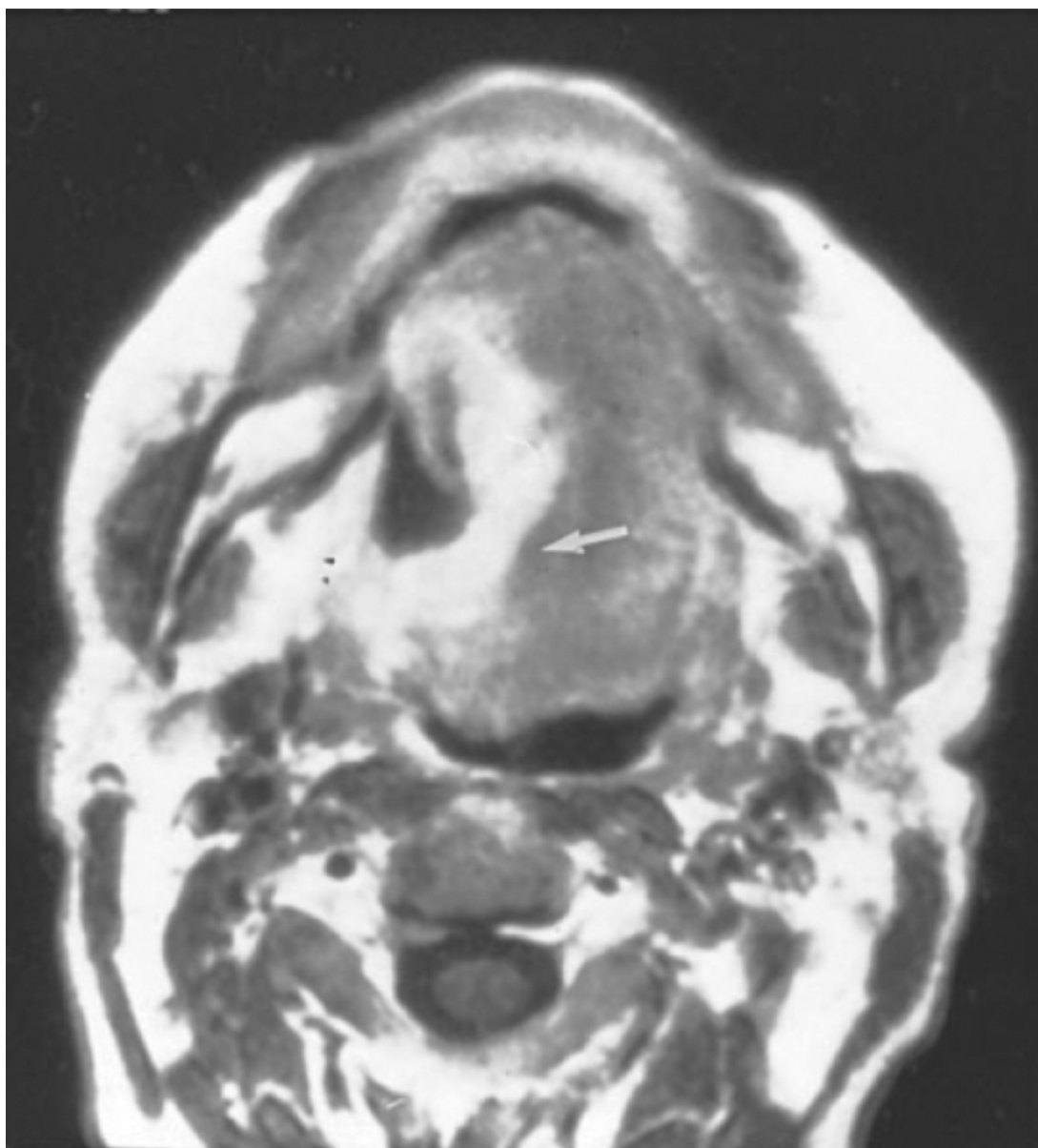


Figure 28-12 Magnetic resonance imaging (MRI) scan demonstrating a large cancer (*arrow*) infiltrating the tongue.

When soft tissue replacement is the only concern, I rely on regional pedicle flaps, particularly the pectoralis major myocutaneous flap (Fig. 28-13). This flap provides adequate muscle bulk and epithelial coverage, and is more expeditious than a free flap, which requires a much longer operation. A midline mandibulectomy provides exposure for total glossectomy (Fig. 28-14). The incision is made along the floor of the mouth. The tongue is released into

the wound and the incision is made across the vallecula to release the specimen (Fig. 28-15). The specimen, including anterior segment of the mandible and total glossectomy, is removed for frozen section analysis (Fig. 28-16).



Figure 28-13 Reconstruction with a pectoralis major flap in a patient who has undergone total glossectomy.

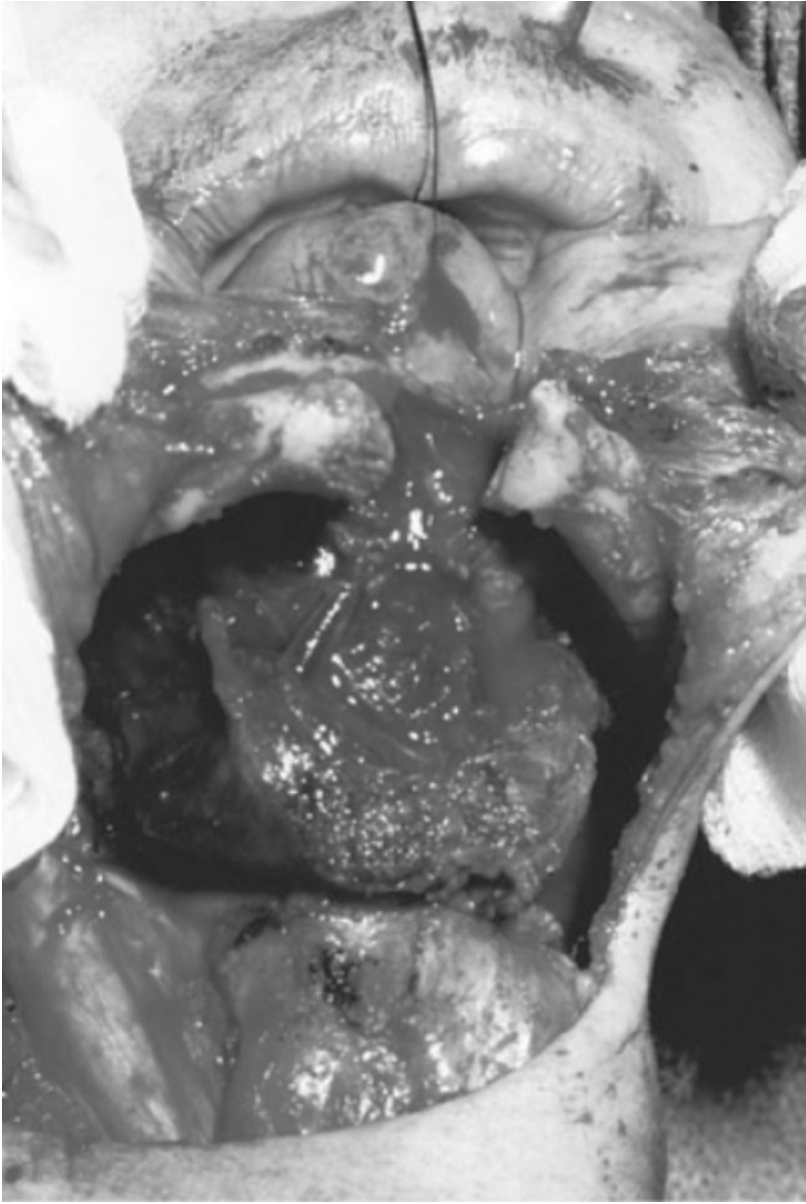


Figure 28-14 Midline mandibulotomy provides exposure for total glossectomy.

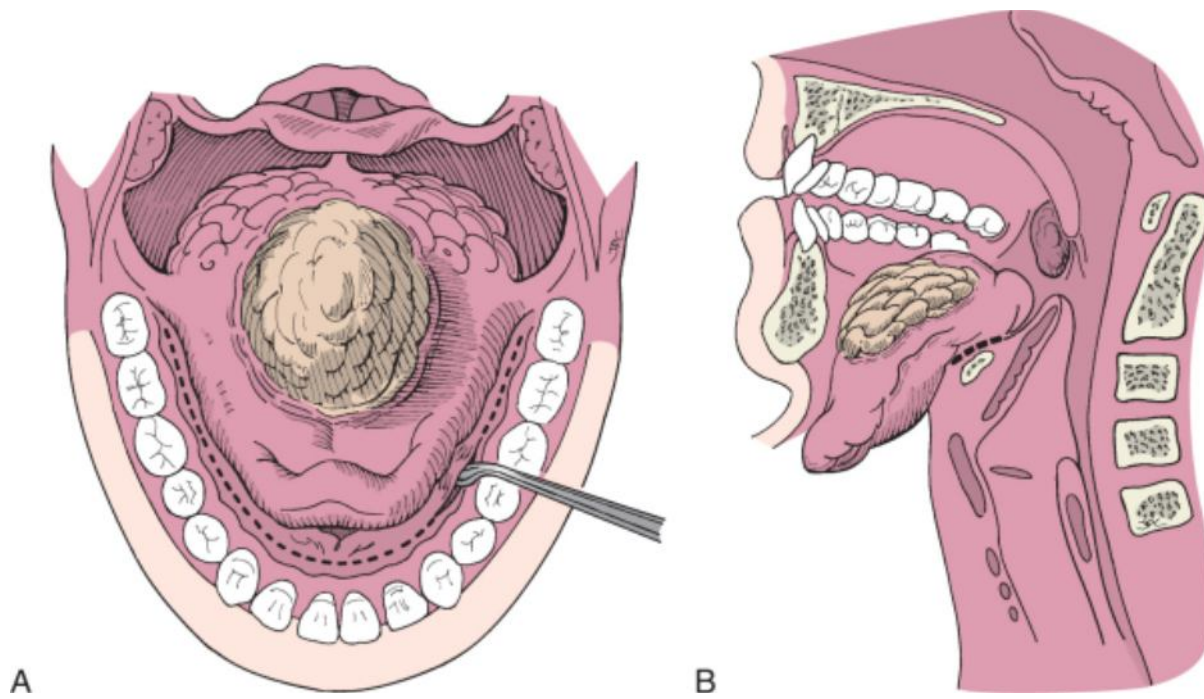


Figure 28-15 A, The incision is made along the floor of the mouth and undermines the mandibular periosteum. B, The tongue is released into the wound, and the incision is made across the vallecula to release the specimen.

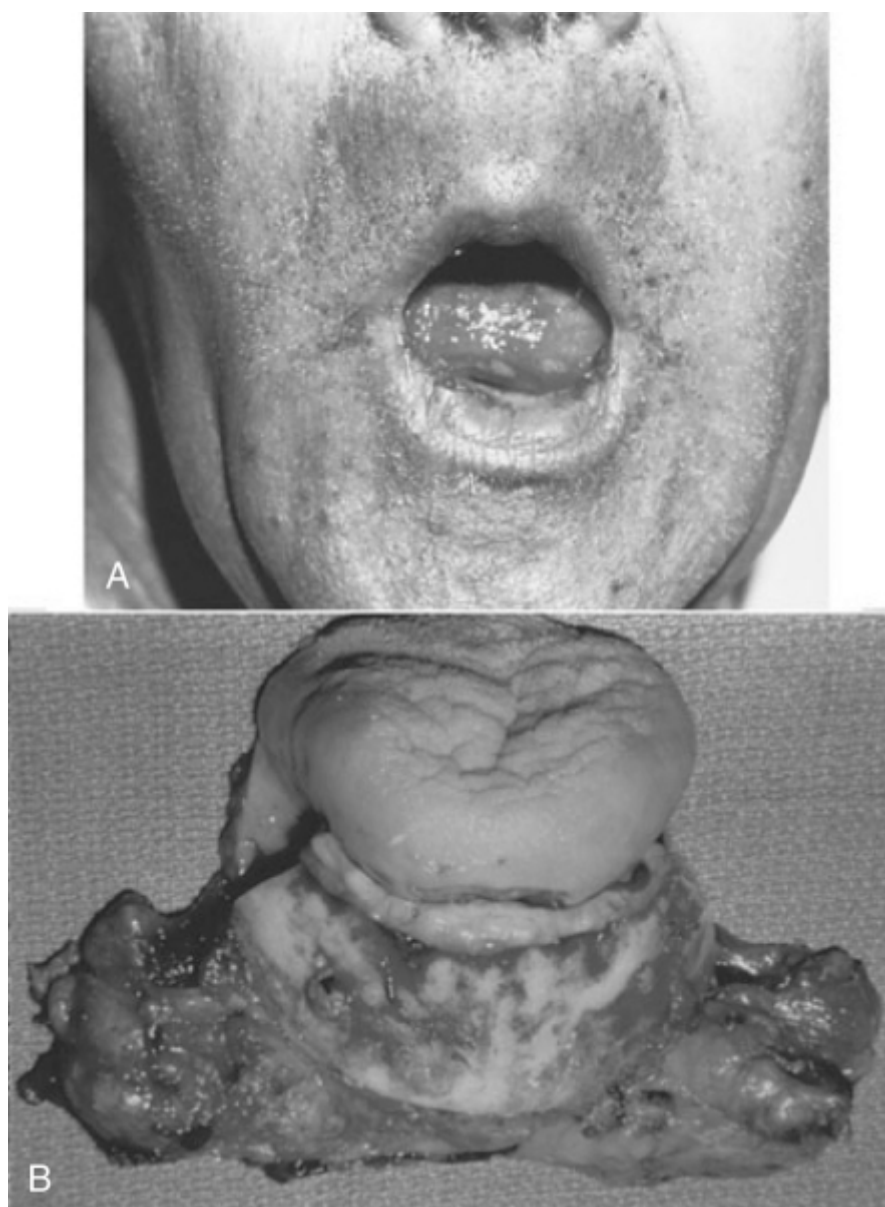


Figure 28-16 A, Postoperative appearance. B, The specimen, including the anterior segment of the mandible and total glossectomy.

A decision must be made as to whether the mandible, if excised, should be replaced. If mandibular re-placement is necessary, I use osteocutaneous free flaps (see chapters devoted to reconstructive techniques). Marginal mandibulectomy is occasionally necessary. It is important to be certain that there is full-thickness epithelial coverage of the bone to protect patients who have undergone irradiation from the possibility of osteoradionecrosis of the mandible.

The speech pathologist should be involved in the early phase of patient evaluation. She or he must assist in counseling the patient about the need for swallowing therapy as well as the need for certain modifications in the speech process that will change the quality and intelligibility of speech. The maxillofacial prosthodontist should also be involved early in the evaluation process in order to fully examine the teeth, make recommendations for extractions when necessary, and make impressions that will assist in the creation of an artificial tongue prosthesis to help with both speech intelligibility and swallowing. Consultation with internal medical specialists is essential to assist in medical evaluation, preoperative therapy, and postoperative management. I have found that history taking and evaluation of the patient's exercise tolerance are more valuable than pulmonary function tests in predicting adequate pulmonary function. It is important that the patient have good pulmonary function and a good cough to prevent aspiration pneumonia in the postoperative course.

Approach to Total Glossectomy

The goal of any surgical approach for patients with cancer of the head and neck is to cure the cancer. Patients requiring total glossectomy usually present with advanced local and regional disease and often have failed other treatment modalities. As a result, they may be suffering from severe pain as well as from impairment of speech

and deglutition. Radical surgery with the goals of pain relief and rehabilitation of the speaking and swallowing mechanism often becomes the main objective, because cure is unlikely for these patients.

Total glossectomy without laryngectomy was not always well understood or accepted by the majority of head and neck surgeons.^[17] Most surgeons, in fact, thought that it was not possible to leave the larynx in place following total glossectomy because breathing and swallowing would be compromised. Until recent years, use of this procedure was also limited by the lack of reliable techniques for immediate reconstruction of this large defect. Patients who are old or poorly motivated, or who have substantial comorbidities, specifically poor pulmonary function, should have a total laryngectomy with the total glossectomy because it is unlikely that such patients would be able to tolerate the attendant operation.

One of the most important aspects in preoperative planning is nutritional assessment for advanced tumors. Patients who have lost 15 to 20 pounds over the several months before presentation are usually malnourished even though they may not appear to be cachectic or have a particularly low serum albumin. To ensure proper healing, these patients should undergo rapid nutritional replenishment, preferably via nasogastric or gastrostomy tube, the latter of which is likely to be needed for adjuvant therapy. A large wound such as with total glossectomy with its inherent need for regional or free flap reconstruction creates a wound that may have already been irradiated. Therefore the tissue is compromised in its circulation. These are two of the many reasons that the patient's nutritional condition must be maximized in order to maximize successful healing.

SURGICAL TECHNIQUE

The surgical approach for total glossectomy with preservation of the larynx is selected after consideration of several factors:

- The size and location of the tumor
- Invasion of the mandible and the need for mandibulectomy
- The need for neck dissection

Given these aspects of the selection process, there are a number of possible approaches to the primary tumor:

- Transoral
- Transhyoid pharyngotomy
- Midline mandibulotomy and mandibular swing
- Lateral pharyngotomy (Fig. 28-17).

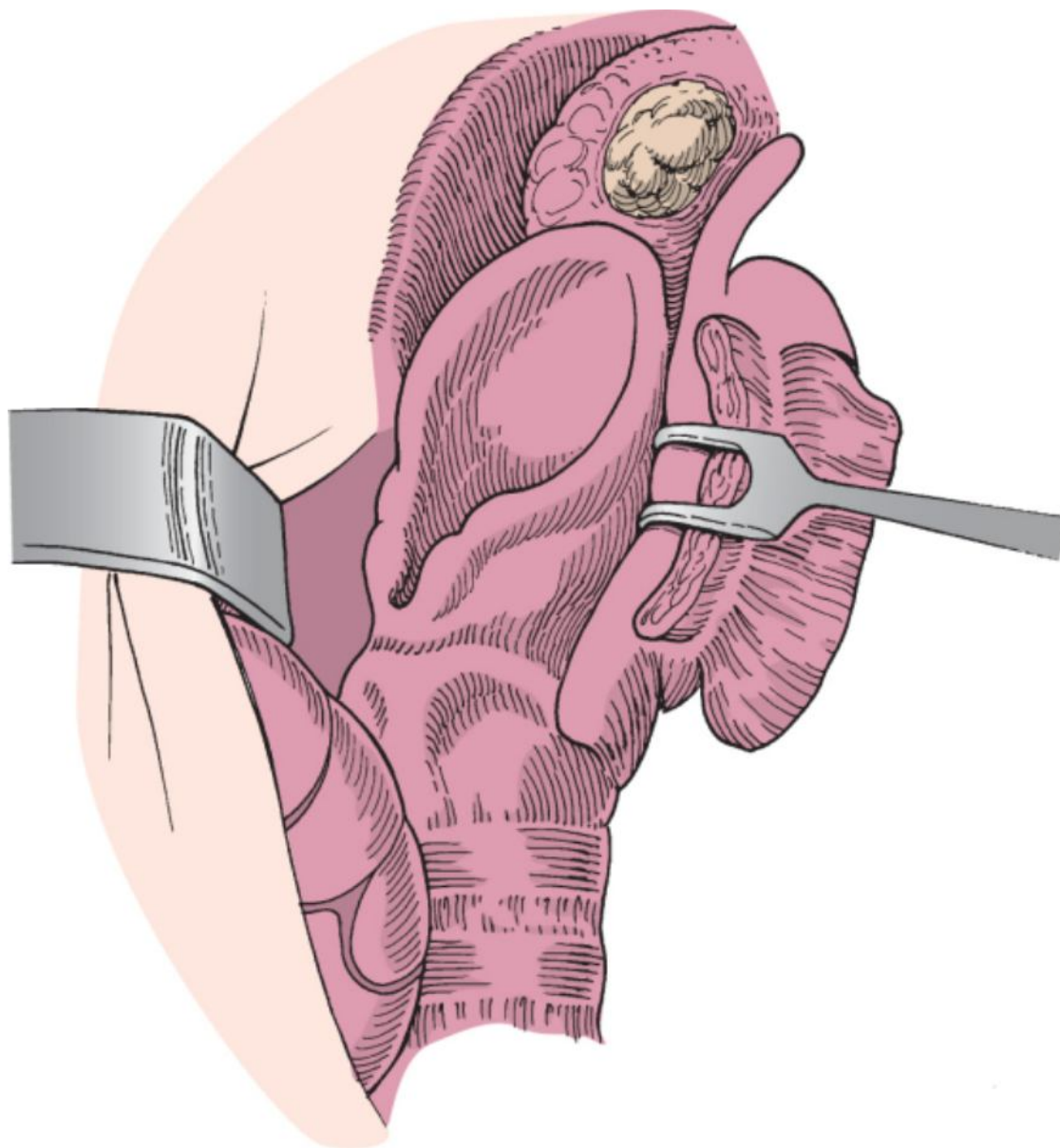


Figure 28-17 Total glossectomy carried out via a lateral pharyngotomy approach.

Unless a midline mandibulotomy is to be carried out (see Fig. 28-14), I prefer to design an apron flap extending from mastoid tip to mastoid tip. Elevation of this flap allows for performance of bilateral neck dissections. Depending on the staging of the neck, this might include bilateral radical neck dissections, bilateral selective neck dissections, or modified, radical, or selective neck dissection on the N+ side and a selective neck dissection on the N0 side. This leaves the surgeon the choice of following the neck dissection with any of the previously mentioned techniques (except midline mandibulotomy).

The choice of the approach to the oral cavity is dictated not simply by the extent of the cancer but by its proximity to other structures. For instance, for the patient who has a cancer arising in the anterior aspect of the oral cavity or floor of the mouth with involvement of the anterior mandible, the approach would be as follows: anterior mandibulectomy, leaving the anterior segment of the mandible attached to the soft tissues of the oral cavity; then, proceeding posteriorly along the floor of the mouth, detaching the tumor from the hyoid bone and then detaching soft tissues of the base of tongue and oral cavity at the level of the vallecula, thus preserving the larynx. When the larynx may have to be removed because of the extent of the tumor, the dissection should not be carried out through a transhyoid approach, because the pharyngotomy incision is being initiated at the line of resection that is the most difficult to evaluate preoperatively. A cancer of the tongue base would be approached through a midline mandibulotomy or a pharyngotomy to give the best exposure to work from the anterior and lateral boundaries of the tumor. It is necessary to proceed toward the posterior (laryngeal) aspect of the dissection in order to increase the possibility of achieving a free margin of resection; if this appears to be impossible, the specimen can be left attached to the larynx, and a total laryngectomy can be carried out.

Most advanced cancers of the tongue are associated with clinically identifiable cervical lymph node metastasis requiring neck dissection. The neck dissection is usually bilateral because these tumors tend to cross the midline. In patients with advanced cancer of the base of the tongue who present without identifiable lymph node metastasis, occult metastasis must be suspected. Therefore surgical planning must include some form of neck dissection in most of these patients. Extensive lesions arising in the anterior portion of the mandible may also require mandibulectomy, either marginal or segmental, to ensure adequate tumor excision. Alternatively, mandibulotomy may be required to provide proper exposure for total glossectomy. Although patients are counseled about the planned preservation of the larynx, they must also be forewarned that if the cancer is more extensive than the preoperative evaluation indicated, the larynx may have to be removed. Plans must also be made to include adjunctive procedures such as tracheotomy and cricopharyngeal myotomy, which I believe are important measures in rehabilitating swallowing following major oral cavity procedures. Reconstructive alternatives must consider repair of soft tissue and possibly bone. The choices for reconstruction include skin graft, regional pedicle flaps, or free flaps (primarily for epithelial coverage) or an osseocutaneous free flap (if a mandibulectomy is required).

POSTOPERATIVE MANAGEMENT

Patients are treated with intravenous perioperative antibiotics over a 24-hour period. Nasogastric tube feedings are begun when bowel sounds are present. In the patient who does not have a skin graft, the nasogastric tube may be removed when the edema has subsided sufficiently that the patient can take an adequate amount of fluids. Patients who have a skin graft in place are fed by nasogastric tube or gavage feeding until the bolster is removed on the fifth day and the tongue regains enough mobility thereafter to permit oral feeding. Frequent suction of the mouth is performed, and the mouth is cleansed three to four times a day with gargles of half-strength hydrogen peroxide and saline solution.

Perioperative antibiotics are used in patients with major clean-contaminated surgical wounds. Great attention has to be paid to management of the neck dissections (see Chapter 78) to make certain that the drains function properly and to detect the formation of hematoma or seroma, chylous leak, or evidence of salivary drainage in the tubes, which may result from wound separation in the oral cavity. Dressings are usually applied to support the wound and to give some compression to the neck flaps. The postoperative care also very much depends on the type of reconstruction. Care of the tracheotomy tube and frequent and vigorous suctioning of the tracheobronchial secretions are enormously important in protecting the patient's airway and helping prevent pneumonia. If there is partial loss of the flap or separation of the intraoral wound with drainage into the neck, every effort must be made to separate the flow of saliva from the oral cavity into the neck to prevent neck infection, particularly in a radical neck dissection in which desiccation and destruction of the carotid artery system may otherwise ensue, possibly leading to carotid rupture.

Patients are downsized to a no. 4 cuffless tracheostomy tube and decannulated when they can tolerate capping of the tracheostomy tube. After the stoma closes, the patient is given instruction in swallowing and essentially uses the same type of swallowing technique as do patients who have undergone supraglottic laryngectomy. The process of swallowing is much downgraded by a total glossectomy, because it essentially converts the first and second phases of swallowing into one phase that is beyond the patient's control. Reconstruction after total glossectomy provides an adynamic conduit between the lips and the pharynx so that the bolus is literally dumped directly into the pharynx. The normal protective features of elevation of the larynx are eliminated because the musculature has been excised. With the bolus spilling into the pharynx and epiglottis area, aspiration is a certainty. The cricopharyngeal myotomy is helpful in trying to eliminate the slight delay in cricopharyngeal opening, which promotes spillover into the larynx.

The patient is taught to take food into the mouth and to do a form of the Valsalva maneuver to close the glottis. As the involuntary stages of swallowing begin, the patient coughs to clear the glottis and then completes the swallowing act and exhales. This new technique of swallowing requires that the patient be able to comprehend and perform the required maneuver and have an effective cough. The texture of food is also important in helping the patient learn to swallow again. The first attempts at feeding are with a nonpourable, puréed diet that holds together so that the bolus may pass more easily into the esophagus without spillage into the airway, as would be likely with thin fluids. Once this aspect is mastered, thin fluids may be attempted. It is often beneficial to use soft drinks with carbonation because the location of this fluid is better "felt" by the patient. Other mechanical adjustments are helpful, such as gulping the bolus with the neck extended. A spoon may be used to actually load the meal directly into the pharynx. This may also be accomplished with a large syringe and a short rubber feeding tube for gavage feedings. Eventually, most of these patients will be able to swallow a thick, puréed diet but not a soft or a normal diet.

COMPLICATIONS

Complications following partial glossectomy may include edema and airway obstruction, hematoma, bleeding, partial slough of the tongue, or loss of skin graft. All of these complications are preventable by meticulous attention to surgical craftsmanship.

It is essential to maintain meticulous hemostasis. The use of the electrocautery in the more superficial tissues, ligatures or clips on the branches of the lingual artery, and deep hemostatic stitches with 3-0 chromic catgut suture provide excellent hemostasis. Closure of the dead space by deep sutures, whether part of a vertical mattress suture or absorbable catgut sutures in the muscle (depending on the extent of the resection), will assist in hemostasis. If a hematoma or bleeding from the tongue develops, it is necessary to return the patient to the operating room to evacuate the hematoma or to ligate active blood vessels.

The constant threat in either of these complications is related to the very real danger of airway obstruction. I use a nasopharyngeal airway in patients with very limited glossectomies but always employ tracheotomy in patients with extensive tongue resection and those who have a skin graft, because the bolus is bulky and the sutures tend to tether the mobile parts of the oral cavity, causing aspiration. The tracheotomy is carried out to prevent airway obstruction and, just as importantly, to provide access for suctioning of the tracheobronchial tree to avoid atelectasis and pneumonia. Necrosis of residual tongue may occur if tissue is devascularized by interruption of the vascular supply or by excessive tension of the skin graft bolus on the remaining tongue, giving rise to interference of venous return. This can be prevented by avoiding unnecessary ligation of the vascular supply to the tongue and by ensuring that the bolus is not too large or tied too tightly if a skin graft is used.

PEARLS

- Systematic use of frozen section control is fundamental to cure of the primary cancer.
- Underestimation of the size of the tumor is avoided by judicious use of clinical and operative physical examination and of imaging studies.
- Recurrence of cancer in the neck is avoided by selective neck dissection at the time of the primary resection.
- Bimanual examination and MRI scans may be very useful in the estimation of the extent of depth of the cancer.
- Total laryngectomy is usually mandatory for older or debilitated patients undergoing total glossectomy to prevent aspiration.

PITFALLS

- The development of recurrent pneumonia and lack of ability to swallow may later necessitate a completion laryngectomy or laryngotracheal separation in patients with total glossectomy.
- Failure to properly mark the specimen may lead to incorrect orientation of the specimen, which may result in inaccurate pathologic evaluation.
- Failure to institute appropriate adjuvant treatment, which is determined by aggressive prognostic clinicopathologic features of the primary cancer and/or metastatic lymph nodes (i.e., perineural invasion, close positive margins, large tumor size, metastasis, extracapsular spread) leads to tumor recurrence in many of these patients.
- Performance of total glossectomy without laryngectomy in a patient with poor pulmonary reserve leads to chronic aspiration and pneumonia.
- Poor healing is predictable in patients who are malnourished on presentation.

* Denotes features optimally treated with adjuvant chemoradio-therapy.[7]

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