

Selection of the appropriate treatment modality is the most difficult responsibility in the management of these patients. Patients should be counseled regarding surgical and nonsurgical options. It is inappropriate to insist that patients undergo one specific form of therapy, particularly when acceptable cure rates can be obtained by other options. Surgeons must be aware of their own biases and strive to present a balanced and informed set of options to the patient and family. Usually, frank discussion with the patient will result in a clear decision regarding the treatment modality most beneficial for the individual patient.

Patients must be counseled regarding the risk of continued smoking, which has been demonstrated to result not only in an increased incidence of second primary cancer and risk of recurrence but also in a reduction in the probability of cure by radiotherapy.¹³ Enrollment in a smoking cessation program and the use of transdermal nicotine replacement, as well as the administration of bupropion, may be helpful. Frank discussion with the patient and family may assist in reducing or eliminating dependence on tobacco. Unfortunately, smoking remains a problem in many patients, even those who have undergone total laryngectomy. Development of a second primary cancer in the lung and esophagus, particularly in patients who continue to smoke after radiotherapy or partial laryngectomy, remains a serious problem and is a common cause of death in patients treated successfully for their initial primary cancer.

TECHNIQUE

The steps for total laryngectomy are listed in Table 49-1.

As in any surgical procedure in which the upper aerodigestive tract is entered through the neck, antibiotics are administered perioperatively. Antibiotics must be administered before initiation of the surgical procedure and continued for 24 hours postoperatively. There is probably no need to continue antibiotics past 24 hours, and the antibiotic must cover gram-positive organisms, as well as anaerobes, essentially normal oral flora.

The patient is anesthetized, a tracheotomy is performed, and an endotracheal tube is placed in the stoma. Care must be taken to perform the tracheotomy at an adequate distance inferior to the cancer if there is significant subglottic extension. It may be necessary to perform the tracheotomy under local anesthesia in patients with large obstructing tumors in whom induction of general anesthesia and endotracheal intubation cannot be accomplished safely.

An apron incision is outlined (Fig. 49-1) such that the tracheostomy incision is incorporated. If neck dissection is to be performed in continuity with the laryngectomy, the apron incision can be extended laterally as a utility incision to gain access to the contents of the neck. Subplatysmal skin flaps are elevated to above the level of the hyoid bone for exposure of both sternocleidomastoid muscles (Fig. 49-2).

Table 49-1 STEPS IN TOTAL LARYNGECTOMY

Administer perioperative antibiotics
Perform a tracheostomy
Make an apron flap incision
Perform a subplatysmal dissection of the flap
Divide the fascia and anterior jugular veins
Expose the sternocleidomastoid muscle and dissect the "outer tunnels"
Incise the strap muscles and elevate them off the thyroid gland
Divide the thyroid isthmus and free the thyroid lobes
Dissect the inner tunnels
Divide the superior laryngeal artery, vein, and nerve
Expose and free the body and greater cornu of the hyoid bone
Rotate the larynx and divide the constrictor muscles
Free the piriform mucosa and superior cornu of thyroid cartilage
Divide the trachea and identify the party wall
Open the pharynx through the vallecula, piriform sinus, or postericoid mucosa
Excise the tumor under direct vision with adequate margins (<1 cm) while preserving as much piriform sinus mucosa as possible
Examine the specimen and select sites for frozen section determination of margins
Insert and secure the nasogastric tube
Close the pharynx via a vertical, horizontal, or T closure with an inverting suture
Do not close the constrictors. Irrigate the wound and test the pharynx for leaks
Create a permanent tracheostoma with pie-crust sutures while remembering to bevel the trachea and "walk the skin" to prevent stomal stenosis
Close the skin over suction drains

The cervical fascia is divided over the sternocleidomastoid muscles, and the incisions are connected inferiorly and superiorly. It will be necessary at this stage to divide and ligate the anterior jugular veins. "Outer tunnels" are bluntly dissected between the sternocleidomastoid muscle and the strap muscles on either side to free the medial contents of the neck (Fig. 49-3). The strap muscles are divided, usually at about the level of the tracheotomy stoma (Fig. 49-4). They are elevated superiorly and medially to gain access to the thyroid gland. The thyroid isthmus is divided (if not done at the time of the tracheotomy), and the contralateral thyroid lobe is freed from its attachment to the trachea (Fig. 49-5). The ipsilateral thyroid lobe is left attached and removed with the specimen. Electrocautery is effective in reducing the bleeding commonly encountered

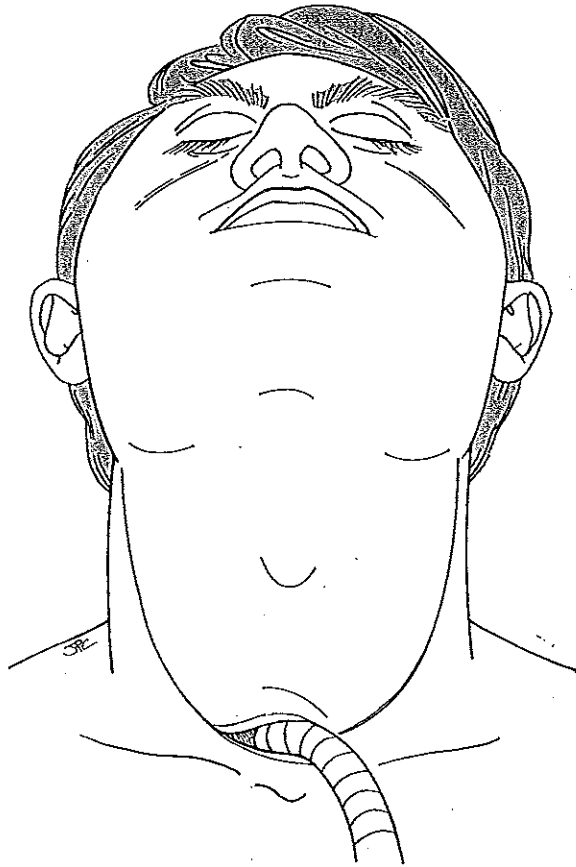


Figure 49-1. Apron incision for total laryngectomy.

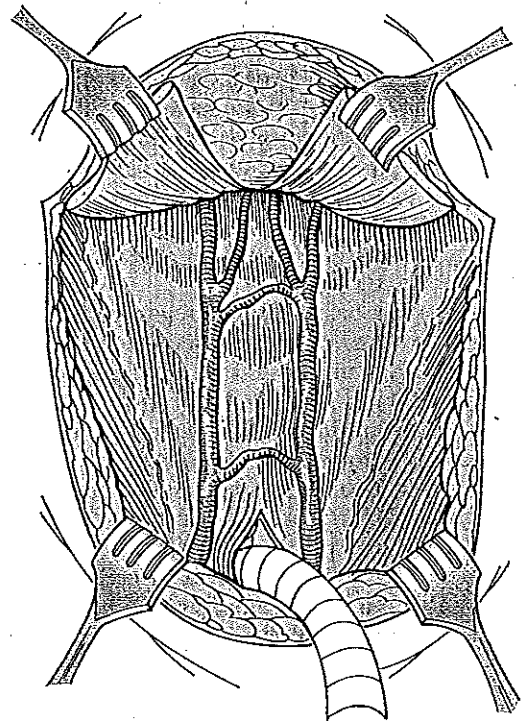


Figure 49-2. Elevated apron incision.

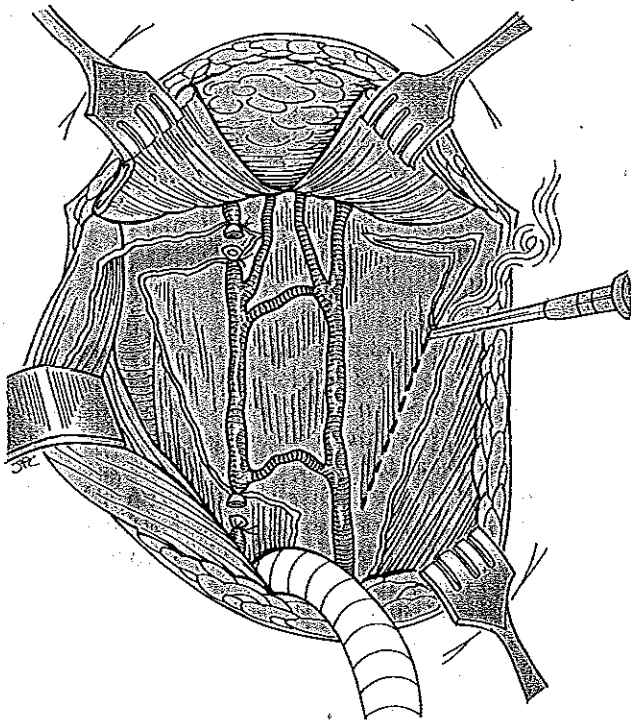


Figure 49-3. Incision of the fascia over the sternocleidomastoid muscle and over the hyoid bone with the development of "outer tunnels" deep to the sternocleidomastoid muscle (right side).

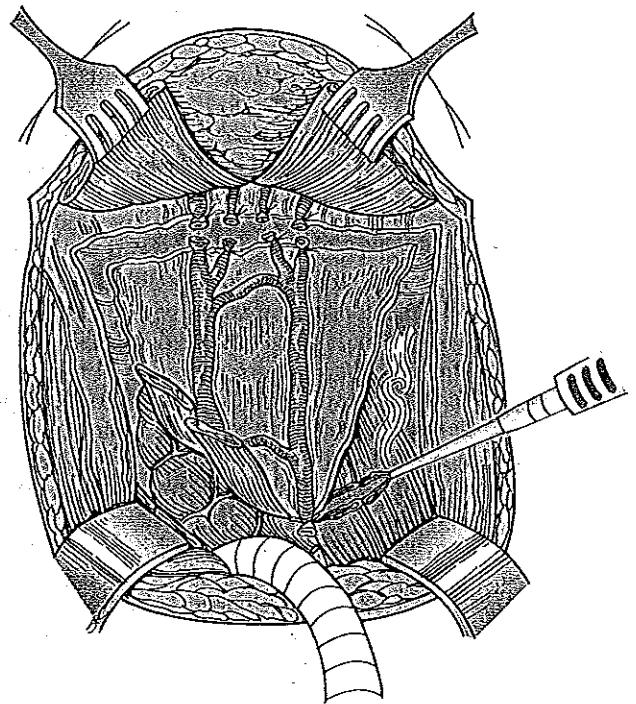


Figure 49-4. Division of the strap muscles.

at this step. The "deep tunnel" between the carotid sheath and the larynx is dissected bluntly along the prevertebral fascia. By dissecting superiorly to the level of the greater cornu of the hyoid bone, the superior laryngeal bundle is encountered and should be ligated.

The hyoid bone is exposed in the midline and grasped with a towel clip (Fig. 49-6). The suprahyoid

muscles are divided, and the hyoid bone is left attached to the thyrohyoid membrane and the strap muscles. When the central portion of the hyoid bone has been released, it is grasped with a towel clip and retracted anteriorly to gain exposure of the lateral cornua. The lateral cornu is grasped with an Allis clamp and pulled away from the hypoglossal nerve and lingual artery. The ligament and its attachments are divided to free the cornu. It is important at this stage to stay on bone to avoid injury to the hypoglossal nerve and lingual artery (Fig. 49-7).

The larynx is rotated by placing a hook under the lateral aspect of the ala. The constrictor muscles are then incised along the lateral border of the thyroid cartilage (Fig. 49-8). Piriform mucosa is bluntly elevated

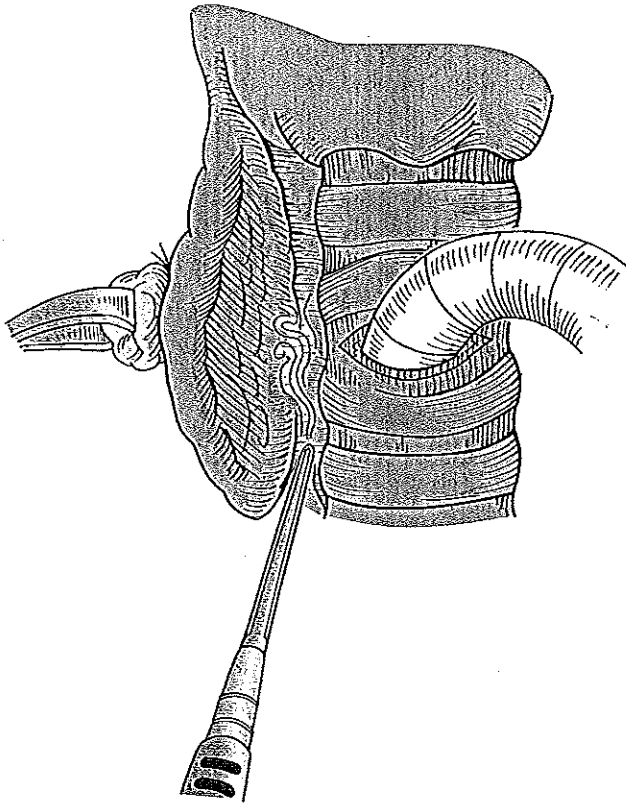


Figure 49-5. Separation of the thyroid lobe from the trachea. Electrocautery is effective in reducing bleeding.

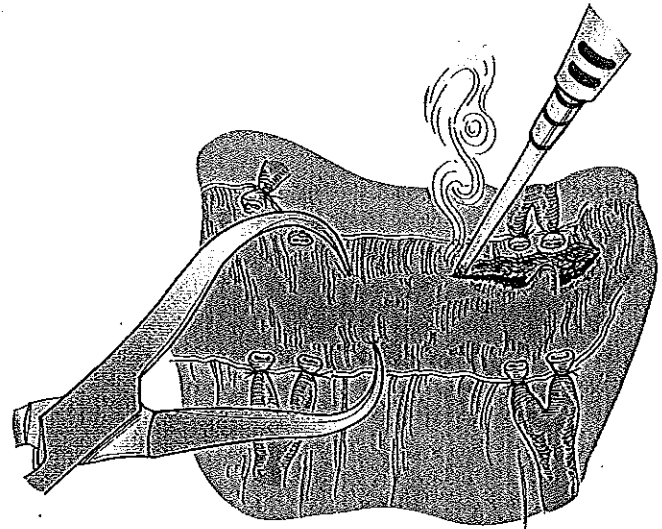
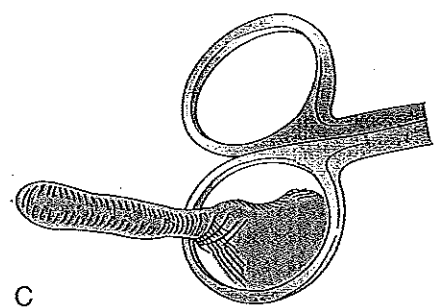
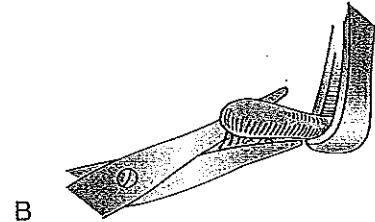
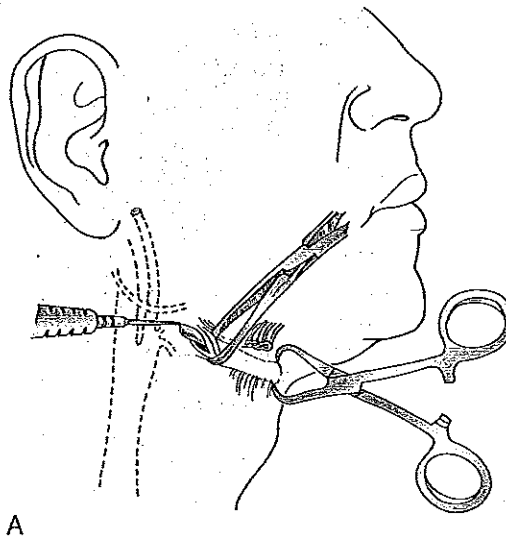


Figure 49-6. The hyoid bone is grasped with a towel clip and the suprahyoid muscles dissected from bone via electrocautery.

Figure 49-7. Freeing the greater cornu of the hyoid bone. Care must be taken to keep the dissection on the undersurface of the hyoid to avoid injury to the lingual artery and hypoglossal nerve. This is done by retracting the lateral cornu with an Allis clamp and exposing the tip of the hyoid (A), incising immediately deep to the cornu with scissors (B), and bluntly dissecting the bone from the piriform sinus wall with the handle of the scissors (C).



A

B

C

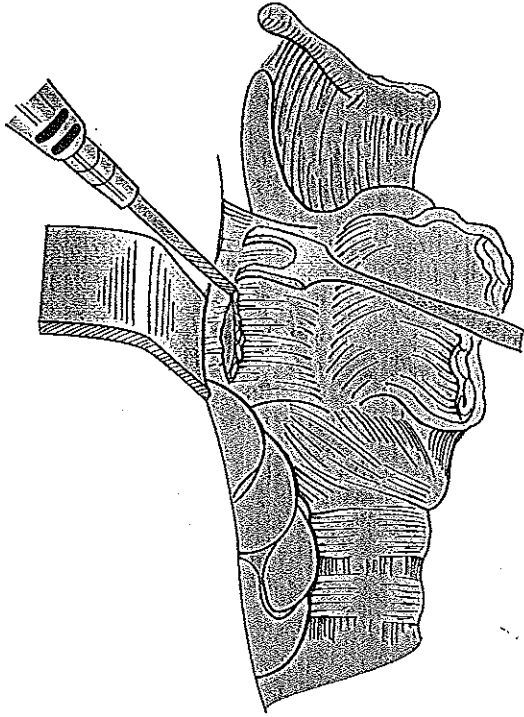


Figure 49-8. Lateral rotation of the larynx to assist in incising the inferior constrictor muscle along the lateral margin to the thyroid ala.

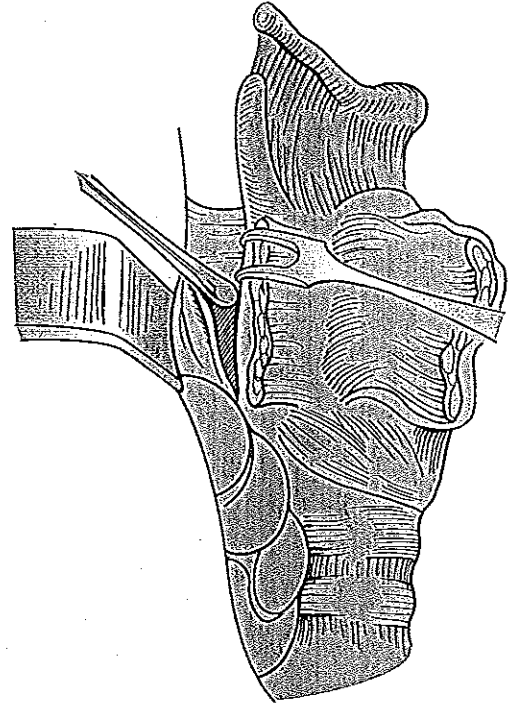


Figure 49-9. Elevation of the piriform mucosa to assist in preserving the mucosa. This step is key to ensure that adequate mucosa is preserved for closure of the pharynx.

from the undersurface of the thyroid ala (Fig. 49-9) (unless there is ipsilateral involvement of the piriform sinus mucosa by cancer). This maneuver will assist in preserving mucosa needed for closure of the pharynx and is particularly important if the contralateral piriform mucosa must be sacrificed.

The trachea is divided, and the posterior wall of the trachea is separated from the cervical esophagus. Blunt dissection superiorly will free the larynx up to the level of the postcricoid mucosa (Fig. 49-10). The larynx is now freed except for its attachments to the pharyngeal mucosa.

The pharynx can be entered in one of several ways. Ideally, the surgeon is familiar with several choices and selects one distant to the site of the tumor to afford maximal exposure and provide direct visualization of the cancer. Unless involved by tumor, the most expeditious approach is to enter through the vallecula. The hyoepiglottic ligament is identified by dissecting posteriorly from the hyoid (Fig. 49-11). By following this ligament posteriorly under the tongue musculature, the epiglottis can be identified and grasped with an Allis clamp and the mucosa incised to enter the vallecula. It is useful for the surgeon to put on a headlight at this time and move to the head of the table. With scissors and careful visualization of the mucosal surfaces, the larynx can be examined in detail and resected while taking care to ensure preservation of uninvolved pharyngeal mucosa to allow adequate mucosa for later closure (Figs. 49-12 to 49-14). This technique conserves maximal pharyngeal mucosa for closure (Figs. 49-13B

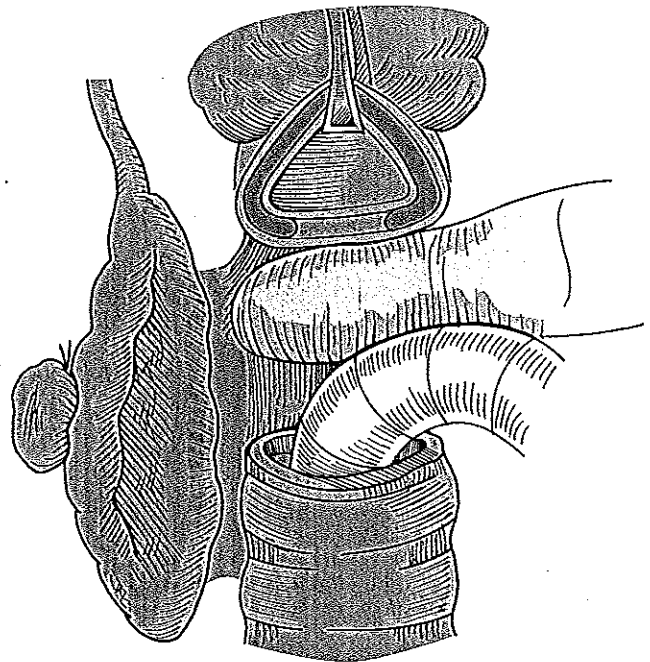


Figure 49-10. Division of the posterior wall of the trachea and dissection to the postcricoid region. The most difficult part of this dissection is identification of the correct plane of dissection. Once the correct plane is identified, the dissection is easily performed with a finger.

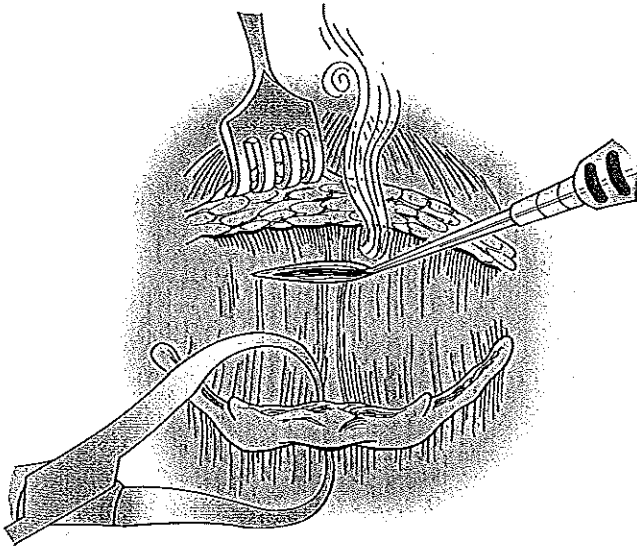


Figure 49-11. Identification of the epiglottis is eased by following the hyoepiglottic ligament. With adequate retraction, the epiglottis is exposed and the pharynx is opened into the vallecula. This is usually farther from the hyoid bone than would be suspected.

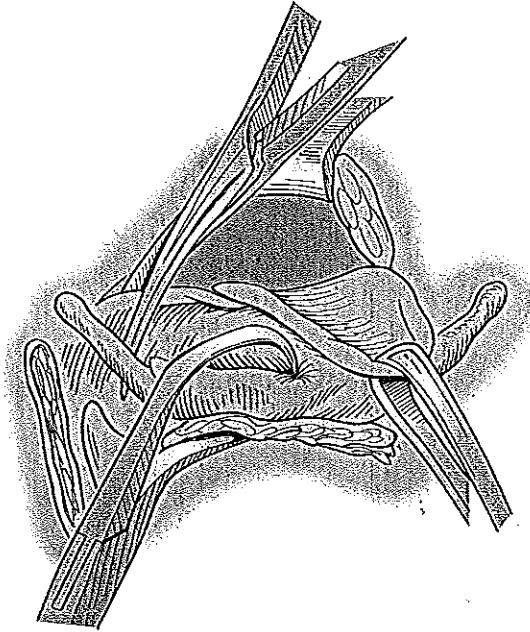


Figure 49-12. Excision of the larynx is begun by incising the pharyngoepiglottic fold while staying just lateral to the aryepiglottic fold. The outside scissors blade will be medial to the hyoid and the thyroid ala.

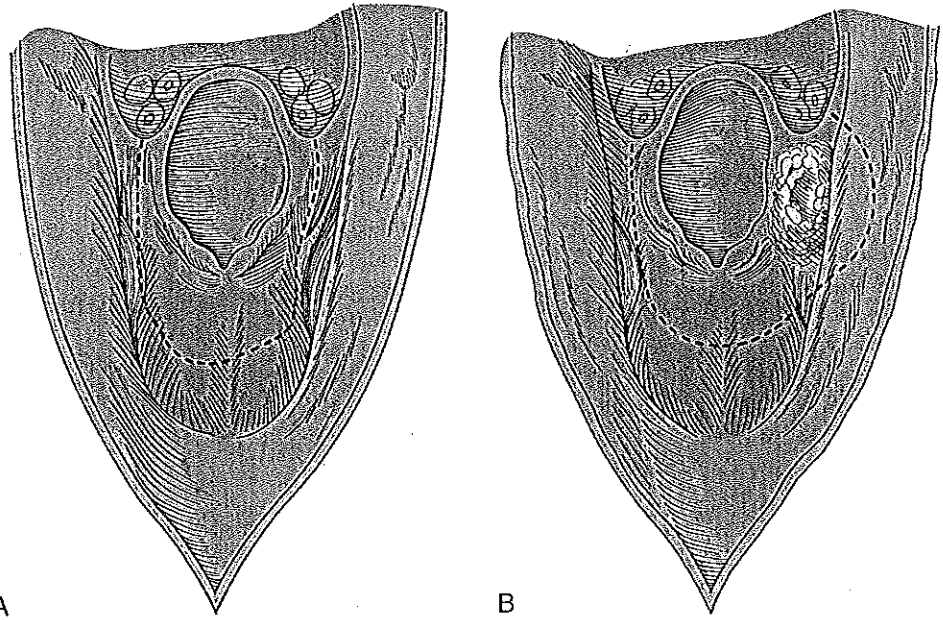


Figure 49-13. A and B, Mucosal cuts for excision of the larynx, with care taken to preserve as much of the piriform mucosa as feasible. The piriform mucosa must be sacrificed if the cancer extends over the aryepiglottic fold or is within the piriform sinus (B).

and 49-14). It is critical that hypopharyngeal cancers be accurately assessed preoperatively to ensure that adequate mucosa will remain for pharyngeal closure. The specimen is resected and submitted for pathologic evaluation (Fig. 49-15). It is unnecessary to obtain frozen sections because adequate margins are the purpose of this operation.

After hemostasis is obtained, a nasogastric tube is inserted through the nose, brought out into the pharynx, and passed into the esophagus and secured.

If a tracheoesophageal puncture is planned, it is performed at this time, as described in Chapter 50. Care must be taken during tracheoesophageal puncture to ensure that the tract does not communicate with the neck but passes directly through the posterior wall of the trachea into the esophagus. Some surgeons routinely denervate the pharyngeal muscles or perform a myotomy by dividing the constrictor muscles along the posterior aspect of the pharynx to assist in postoperative voicing.

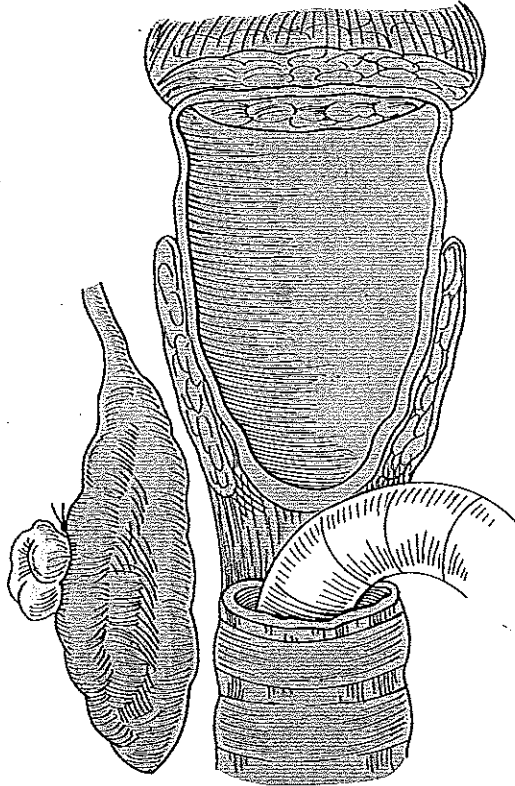


Figure 49-14. Defect after removal of the larynx. Note the preservation of the piriform sinus mucosa.

The type of closure will often be dictated by the amount of remaining piriform sinus mucosa. The pharyngeal mucosa is closed with running inverting suture (Fig. 49-16), usually in a T, vertical, or horizontal fashion (Fig. 49-17). The suturing technique is critical, and more than one individual should be observing each suture to ensure that the mucosa is inverted. Reinforcing sutures may be used; however, the constrictor muscles should *not be closed* because this will contribute to postoperative dysphagia and difficulty with voicing if speech rehabilitation with a tracheoesophageal puncture is used.

The wound is irrigated, and the stoma is created by half-mattress sutures (Fig. 49-18). Stoma stenosis can be prevented by beveling the tracheal incision and advancing skin by taking larger bites on the skin side than on the tracheal side during closure. Hemovac suction drains are used. The neck incision should not be closed until the stoma has been created, and then the neck incision can be closed in the typical manner with absorbable deep sutures and skin staples. A dressing is applied and secured to assist in coapting the skin flaps. The anode tube is removed and a cuffed tracheostomy tube inserted. We generally use a no. 8 cuffed tracheostomy tube that is changed to an uncuffed laryngectomy tube after several days.

The patient is fed by nasogastric tube when bowel sounds are heard. After the appropriate period, usually about 7 days, the nasogastric tube is removed and the

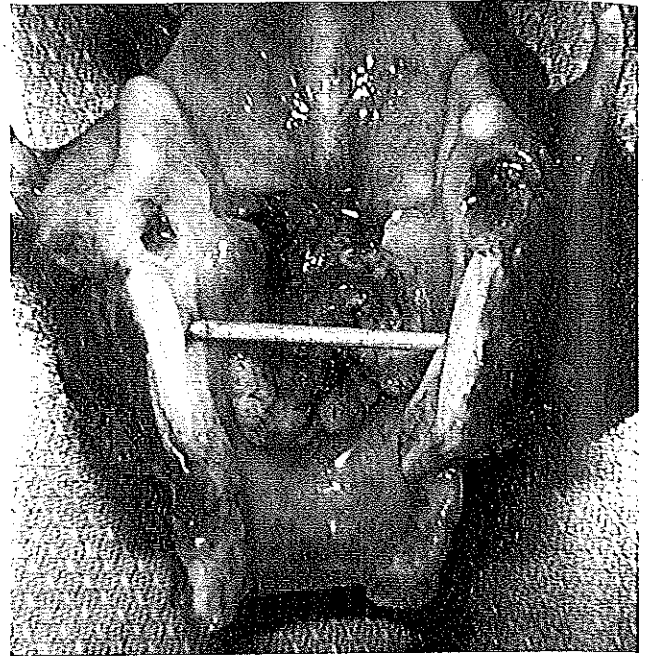


Figure 49-15. Laryngeal specimen opened to show transglottic cancer. The cancer is crossing the anterior commissure from superior to inferior.



Figure 49-16. Closure of the pharynx with detail of the suturing technique. Mucosal edges must be inverted or a fistula will develop.

Figure 49-17. Three types of pharyngeal closure. A T closure (A) is most common, although the T is technically difficult and prone to leakage. Vertical (B) or horizontal (C) closure can be performed if adequate mucosa is preserved, and these closures may be preferable.

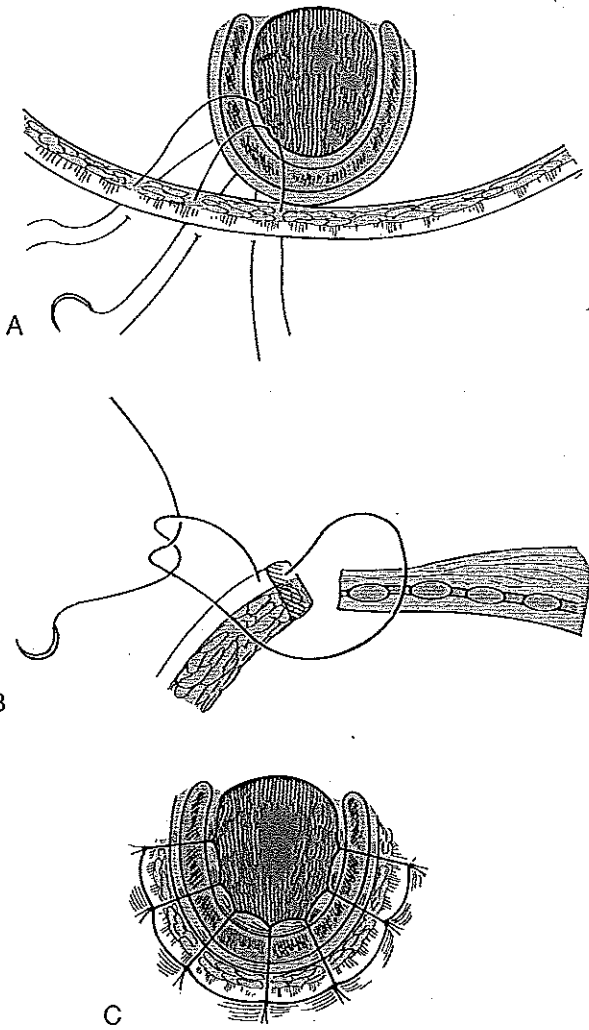
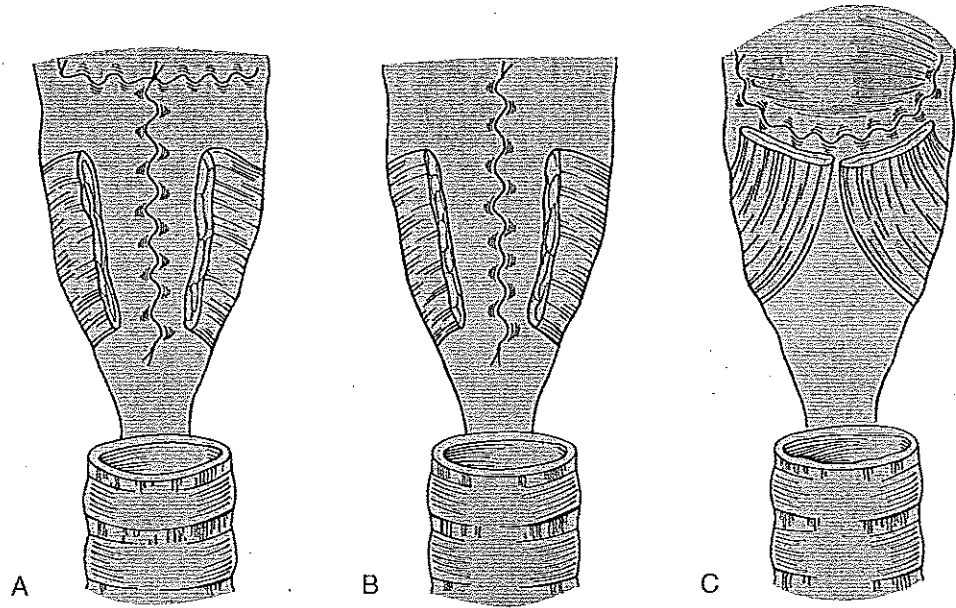


Figure 49-18. Creation of the stoma with half-mattress sutures. A, The skin flaps are "walked" medially to ensure adequate stomal diameter by taking wider "bites" of skin than of trachea with each suture. B, Detail of a half-mattress suture. This technique pulls skin over the tracheal edge to cover cartilage. C, Stomal closure. In actuality, the half mattress sutures pull the skin over the exposed tracheal rings.



Figure 49-19. Barium swallow in a patient who has undergone total laryngectomy with a small pharyngeal leak. If small, it may respond to conservative treatment and not progress to a pharyngocutaneous fistula.

patient is maintained on a liquid diet. Patients who have previously undergone radiotherapy or in whom the pharyngeal closure is difficult or who demonstrate erythema of the flap with or without fever are studied with an esophagogram before initiating an oral diet. Identification of a sinus tract is an indication to delay the oral diet and continue tube feeding until it is clear that a fistula or a sinus tract is not present (Fig. 49-19).

PEARLS

- Not every patient is best served by total laryngectomy. Discussion with the patient will usually lead to a clear understanding of the patient's preferences for therapy.
- Conservation laryngeal procedures require that the tumor and the patient both be amenable to the planned procedure. Do not perform conservation, horizontal procedures on patients in whom aspiration will be a problem.
- Extension beyond the larynx to the subglottis, base of the tongue, and hypopharynx increases the chance of leaving persistent tumor behind. Frozen section evaluation of surgical margins is necessary.
- A carefully performed pharyngeal closure is key to avoiding a postoperative fistula.
- A tracheotomy under local anesthesia may be necessary in patients with a large obstructive laryngeal cancer.

PITFALLS

- The most common pitfall in the surgical management of laryngeal carcinoma is failure to accurately stage the tumor and thereby make an inappropriate choice of therapy. Repeat endoscopy just before the procedure is helpful, particularly when the patient has undergone diagnostic endoscopy and biopsy elsewhere.
- Failure to administer perioperative antibiotics will result in an unacceptable rate of wound infection in patients in whom the upper aerodigestive tract is opened. Each surgeon must establish a system—or confirm that a system exists—to ensure that antibiotics are administered at the right time and in the right dose.

- Continued soiling of the wound with oropharyngeal secretions as a result of technical error during pharyngeal closure is the most common cause of postoperative wound infection and pharyngocutaneous fistula.
- Failure to accurately close the pharynx can result in the development of a fistula. This complication can be prevented by meticulous attention to detail during closure of the pharynx. The closure must be performed without tension and with careful inversion of the mucosa. Adequate wound drainage is necessary to prevent accumulation of fluid, which acts as a culture medium for wound infections.

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