Chapter 42 – Laryngofissure

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Laryngofissure, or median thyrotomy, is the most versatile of the transcervical approaches to the endolarynx. It provides ample exposure to the anterior and posterior aspects of laryngeal anatomy and is associated with minimal morbidity.

The first laryngofissure is attributed to Desault, a French surgeon who used this approach for removal of a foreign body in 1819.[1] During the 1800s, other surgeons attempted the approach for removal of benign and malignant tumors with varying results. In 1862, McKenzie surveyed 28 cases in the literature and condemned the procedure because of its high morbidity.[1] Laryngofissure fell into disfavor until the 20th century, when it gained acceptance as advances in anesthesia, standardization of tracheotomy, a better understanding of the physiology of healing, and the advent of antibiotics reduced the morbidity of the approach. Today, laryngofissure is the most commonly used transcervical approach to the endolarynx.

PATIENT SELECTION

The most frequent indications for laryngofissure include the surgical management of extensive or recurrent stenosis of the glottis, combined glottic-subglottic stenosis, and anterior and posterior glottic webs that are not amenable to transendoscopic resection.[2,3] Laryngofissure may also be used in patients requiring arytenoidectomy and lateralization of the vocal fold for vocal fold paralysis who cannot be approached endoscopically because of anatomic limitations.[4,5] Furthermore, benign and malignant tumors of the larynx can be accessed via laryngofissure, provided that sound oncologic principles are followed.[6–10] Many congenital laryngeal anomalies are also amenable to correction through this approach.[11] Finally, laryngofissure may be used to approach and repair traumatic injuries to the larynx.

PREOPERATIVE EVALUATION

Laryngofissure and cordectomy were the standard of care for T1 to T2 cancers of the glottis for many years. It is essential that the cartilage and posterior and anterior commissures not be involved with tumor. Information concerning such involvement may be ascertained preoperatively with computed tomography of the larynx and flexible fiberoptic and direct laryngoscopy. If transglottic involvement is suspected, it may be better defined preoperatively by magnetic resonance imaging. In general, however, we prefer hemilaryngectomy for the resection of malignant tumors not amenable to endoscopic resection, because in our experience, hemilaryngectomy yields a better voice than laryngofissure and cordectomy do. A possible exception to this principle is the local resection of verrucous carcinoma, which is characterized by extension with a “pushing” rather than an infiltrative border and subsequently may not require ablation of the deep tissues of the glottis or thyroid cartilage.

Benign tumors that are not amenable to a transendoscopic approach, either because of extension or because they are poorly visualized (i.e., a patient with cervical spine fusion), may be approached through a laryngofissure. An important contraindication to this approach is active laryngeal papillomatosis. Any attempt to remove the papillomas transcervically may result in dissemination of the disease to the deep tissue planes of the neck with obvious catastrophic results.

Patients with extensive anterior commissure webbing, especially if the web has a substantial vertical dimension, may be approached through a laryngofissure. This technique permits lysis of the entire web and placement of a keel to allow re-epithelialization of the glottis and subglottis. Most posterior commissure webs are the result of prolonged endotracheal intubation. These webs tend to be broad based and leave considerable submucosal scarring. The laryngofissure approach allows thorough excision of not only the web but also its submucosal scar. Use of a local flap of pharyngeal mucosa rotated into the defect produces reliable results in restoring the airway.

TECHNIQUE

Laryngofissure is classified as clean-contaminated surgery. Prophylactic perioperative antibiotics are recommended. The antibiotic selected should provide coverage of bacterial flora of the upper aerodigestive tract (e.g., clindamycin or ampicillin-sulbactam). It is administered before surgery and continued for 24 hours.

General anesthesia is induced only after the airway is secured. Many patients with significant airway compromise as a result of space-occupying lesions, scarring, or trauma will already have a tracheostomy. If not, a tracheotomy should be performed under local anesthesia at the beginning of the procedure. Patients without significant airway compromise may be intubated and the tracheotomy performed under general anesthesia. Direct laryngoscopy is performed before laryngofissure, whenever possible, to assess the extent or severity of any endolaryngeal tumor, stenosis, or trauma.

A horizontal incision is preferred to provide adequate exposure and a good cosmetic appearance. The incision is placed in a skin crease over the midsection of the thyroid cartilage (Fig. 42-1) and carried throughsubcutaneous tissue and the platysma. Flaps are elevated in a subplatysmal plane to expose the hyoid bone superiorly and the caudal edge of the cricoid cartilage inferiorly. This field must be kept isolated from the tracheostomy wound to prevent contamination of the wound from the tracheostomy secretions. The strap muscles are then retracted from the midline to expose the thyroid and cricoid cartilage. The perichondrium of the thyroid cartilage is incised in the midline and elevated laterally to expose the most medial 2 cm of the thyroid alae.

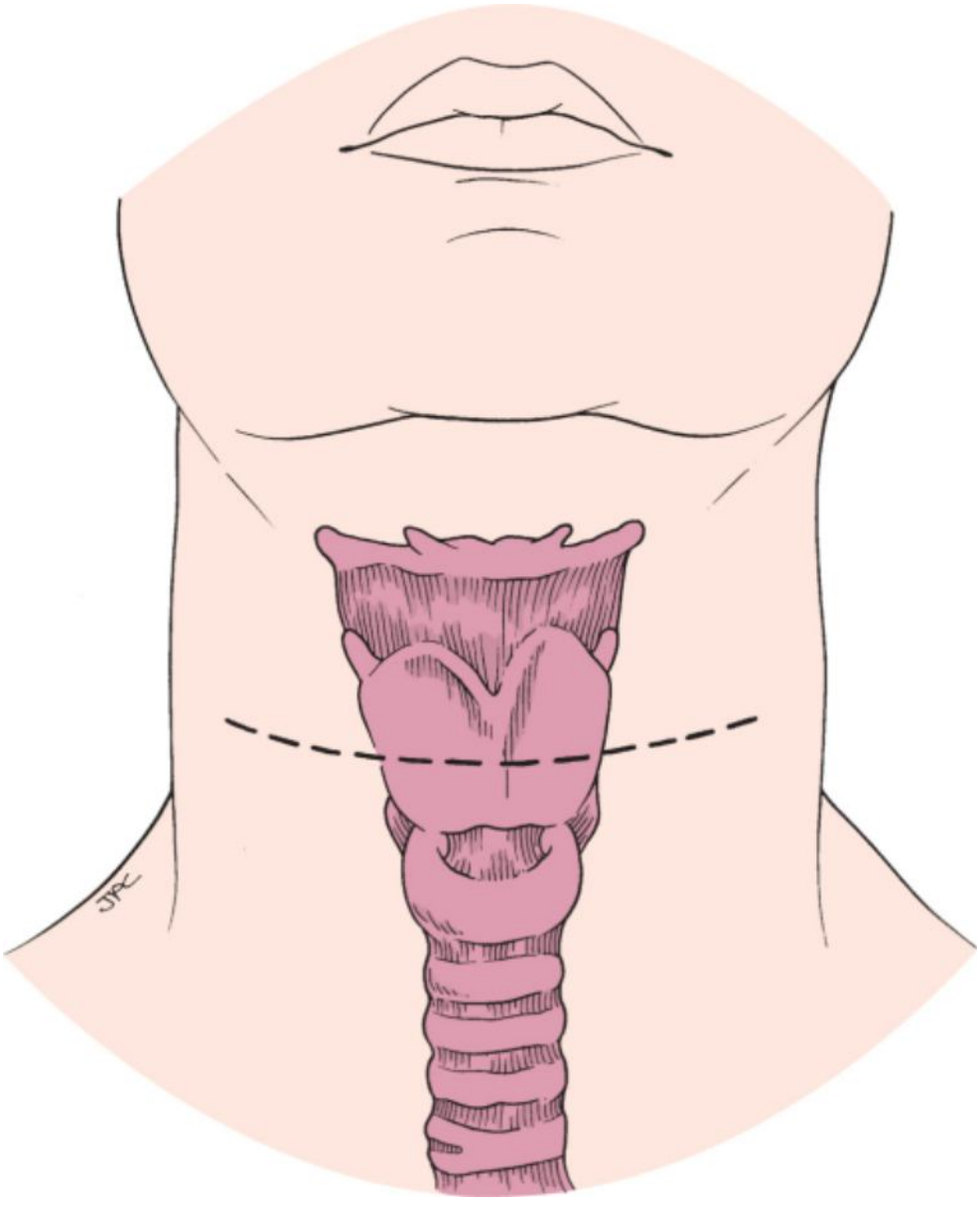

Figure 42-1 Placing the incision in the major cervical skin crease ensures a good cosmetic result. The level of the incision may be adjusted according to the need for exposure of the larynx or trachea.

A preplating technique is completed with a titanium plate conformed to the shape of the midthyroid alae. The screw holes are drilled, and the plate is screwed in place and then removed to perform the laryngofissure (Fig. 42-2).[12] This technique facilitates repair of the thyrotomy at the end of the procedure. The plate fixation preserves the angle of the thyroid alae, which is important to prevent lateral splaying of the thyroid alae with loss of anteroposterior projection.

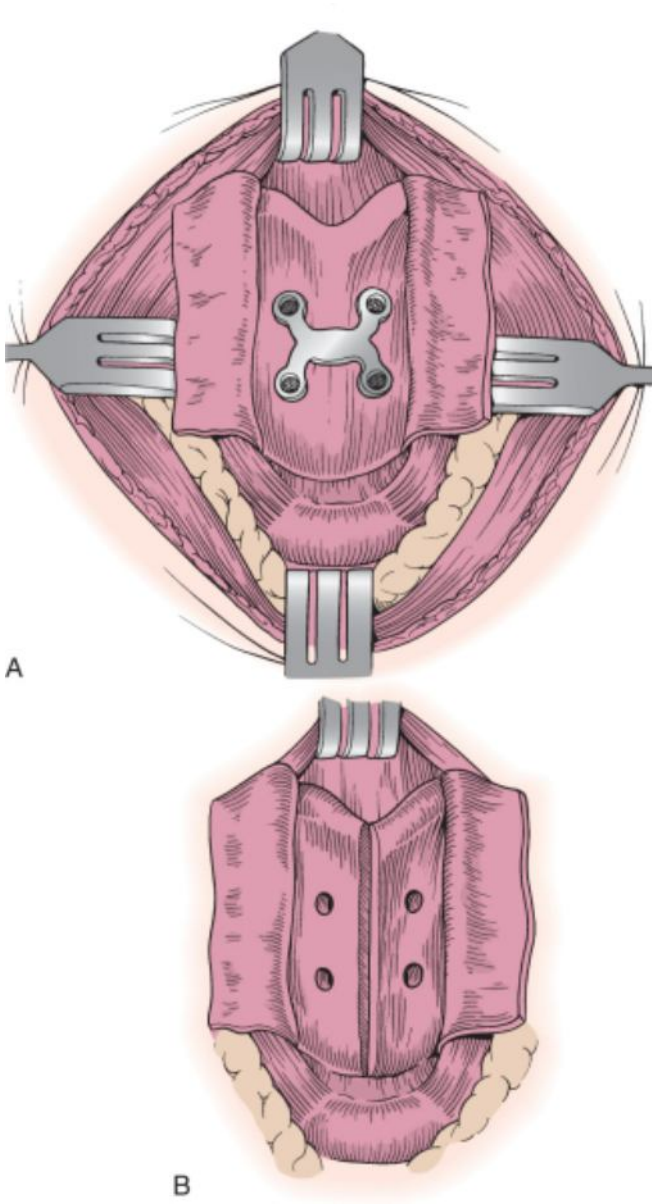

Figure 42-2 **A**, The fixation plate is bent to conform to the shape of the thyroid cartilage, the holes are drilled, and the screws are placed. **B**, The screws are removed, and the median thyrotomy is performed. After the procedure, the plate and the screws are replaced.

A median thyrotomy is performed with the belly of a no. 10 blade for an adult larynx or a no. 64 Beaver blade for pediatric patients. A sagittal or oscillating saw is necessary if the cartilage is calcified. The inner perichondrium should be preserved to avoid damage to the true vocal cords. To visualize the anterior commissure, a horizontal incision is made at the midsection of the cricothyroid membrane, and the thyroid alae are retracted laterally with single- or double-hook retractors (Fig. 42-3). A horizontal incision through the cricothyroid membrane is preferable to a vertical incision because it allows wider lateral retraction of the thyroid alae.

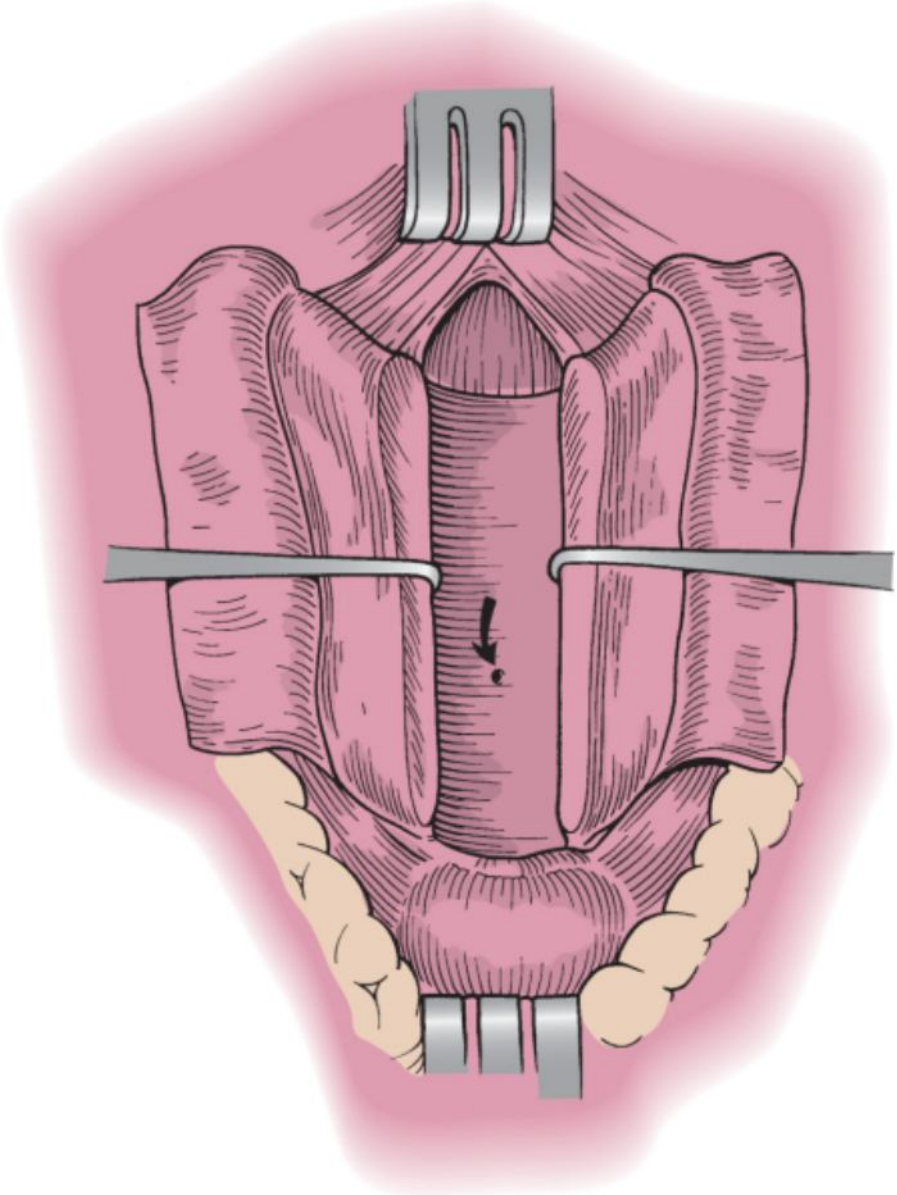

Figure 42-3 The median thyrotomy has been completed, with preservation of the mucosa of the endolarynx. The anterior edges of the thyroid alae are retracted laterally. The *arrow* indicates Montgomery's aperture, which marks the level of the anterior commissure.

The true vocal cords must be transected in the midline at the anterior commissure. This area may be identified through direct visualization or by identifying Montgomery's aperture, which is a small hole inferior to the anterior commissure (Fig. 42-3).[2] Alternatively, the anterior commissure may be divided transendoscopically during direct laryngoscopy. Transendoscopic division of the anterior commissure facilitates its identification during laryngofissure and is especially useful in cases of anterior webbing.

With the endolarynx exposed, the original indication for surgery can be addressed. T1 glottic carcinoma, particularly verrucous carcinoma, that does not involve the anterior commissure or arytenoids can be resected with a standard cordectomy. A paralyzed vocal fold can be managed by arytenoid adduction or by arytenoidectomy and lateralization, depending on the needs of the patient and the goals of surgery. In cases of laryngeal trauma, the soft tissue laceration or avulsion can be repaired at this time. If possible, the laryngofissure may be incorporated into one of the fracture lines. Finally, laryngeal stenosis can be addressed by excision of scar tissue, lysis of webs, and if applicable, local flap coverage. When considerable disruption of the laryngeal mucosa has occurred (e.g., extensive laryngeal trauma or significant scar or web excision), placement of a keel or stent may prevent postoperative scarring at the anterior commissure.

After completion of the endolaryngeal aspect of the operation, the anterior margin of the true vocal cord is reattached to the anterior edge of the corresponding thyroid ala via a horizontal mattress suture with permanent monofilament material (e.g., nylon, Prolene) (Fig. 42-4). This suture will prevent retraction of the vocalis muscle and the associated shortening of the vocal fold, as well as minimize the likelihood of anterior glottic web formation postoperatively.

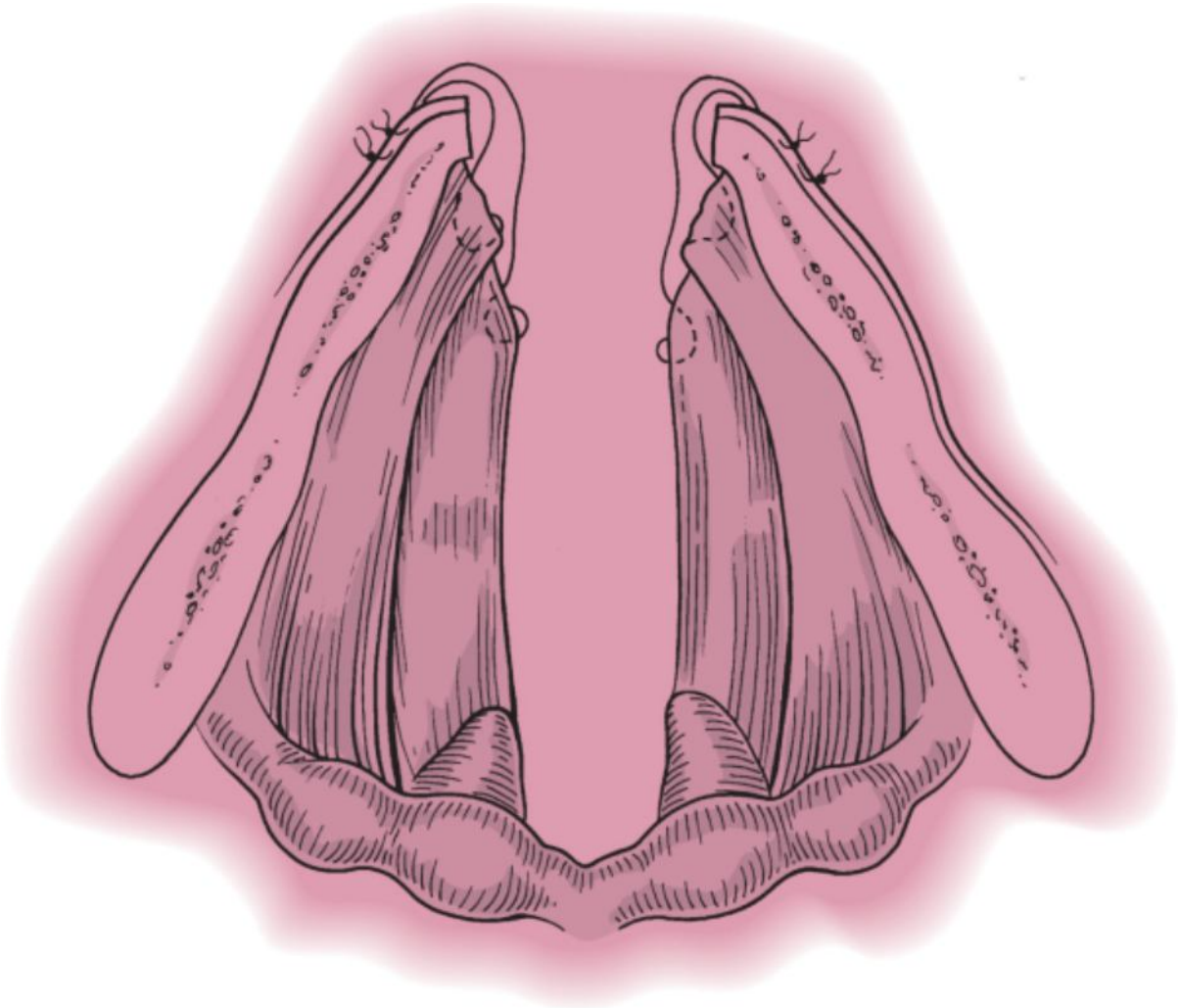

Figure 42-4 Axial view demonstrating repair of the anterior vocal cords by fixation of the tendon of the true vocal cord to the thyroid ala. This technique prevents contraction of the vocal cords and loss of anteroposterior diameter.

The thyrotomy is then closed by replacing the preformed titanium plate (Fig. 42-5). The perichondrium is reapproximated with interrupted absorbable suture (e.g., Dexon, Vicryl) (Fig. 42-6). The strap muscles are approximated in the midline with 3-0 chromic suture. After hemostasis is achieved, a ¼-inch Penrose drain is left subplatysmally and brought out at one of the lateral ends of the wound. The wound is irrigated and the platysma is reapproximated with a similar technique. The skin is closed with 6-0 mild chromic or fast-absorbing gut suture and wound tape. A compressive dressing is applied.

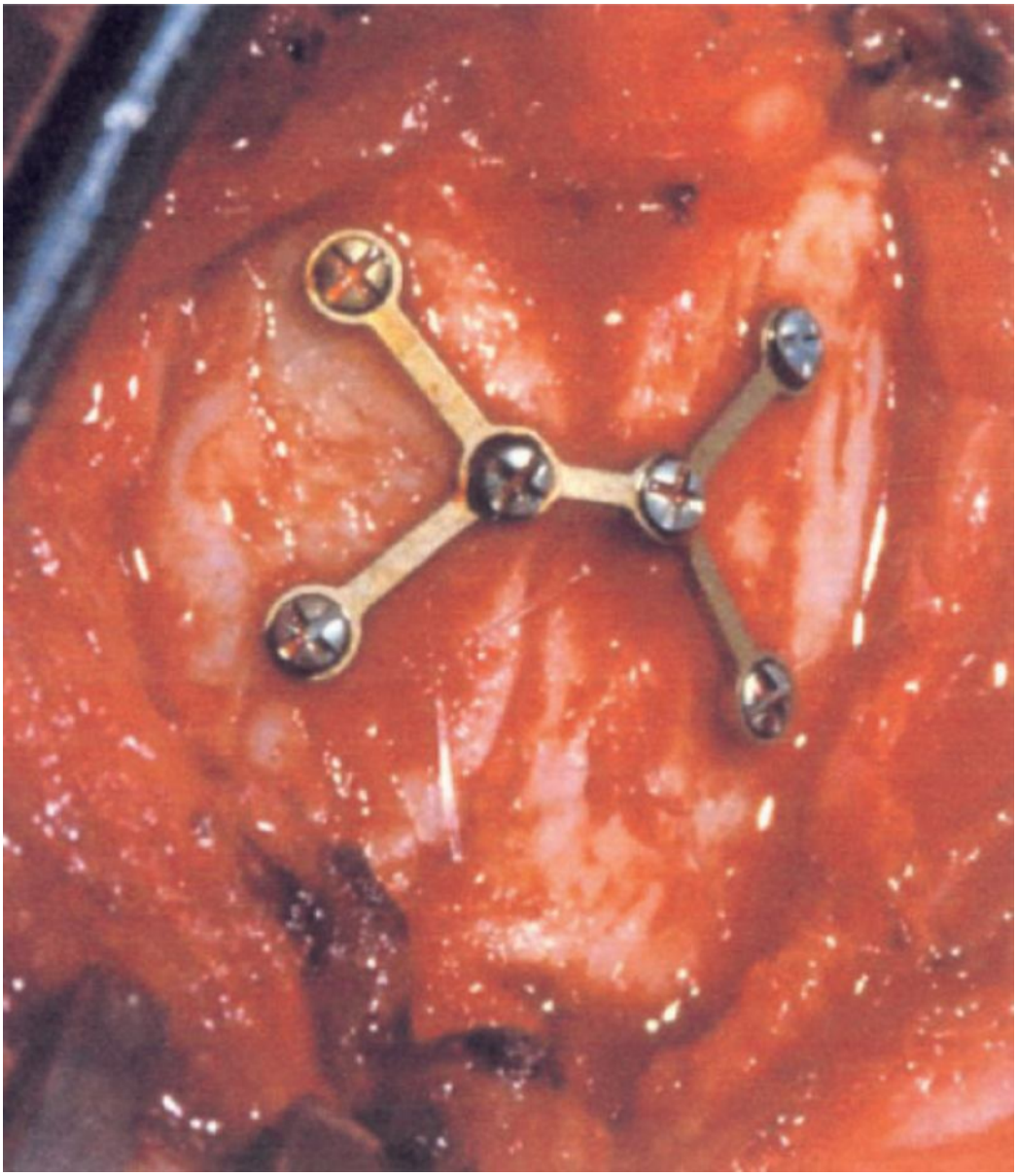

Figure 42-5 Intraoperative photograph taken after the thyrotomy was repaired with plates.

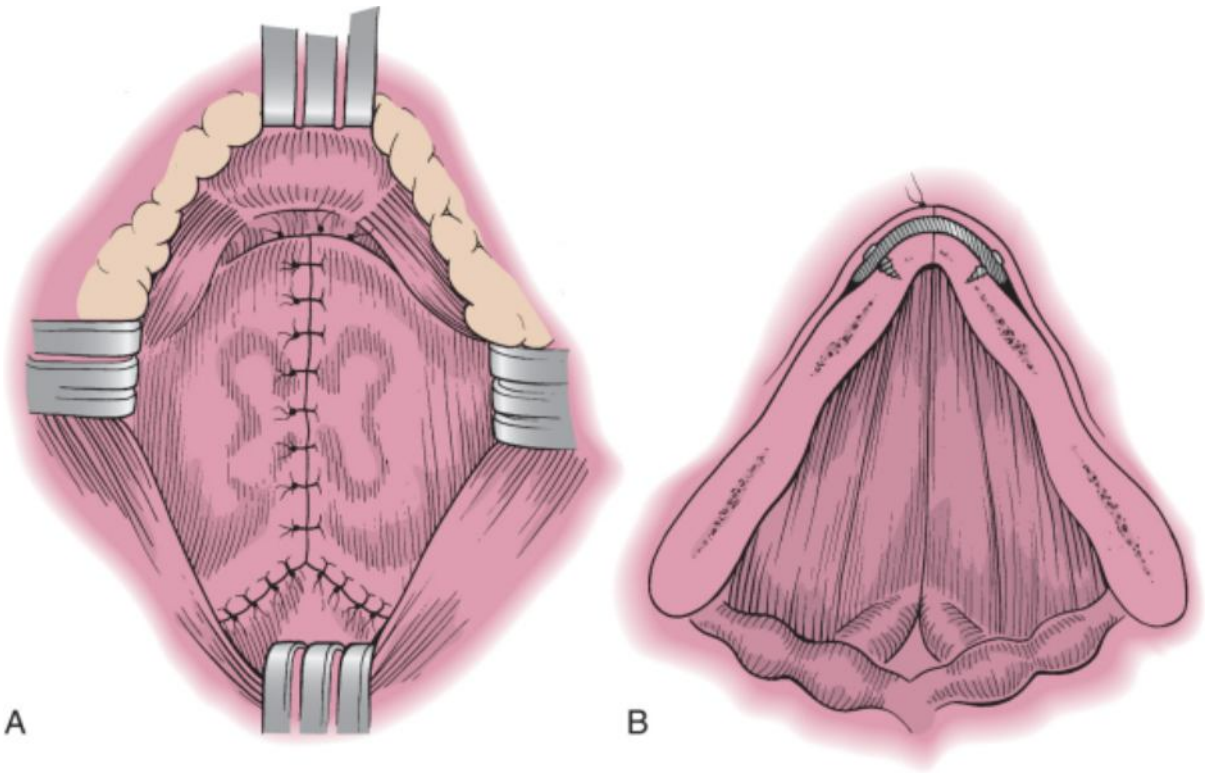

Figure 42-6 **A**, The perichondrium and strap muscles are repaired with absorbable stitches. **B**, Axial view demonstrating plate repair with preservation of the angle of the anterior thyroid cartilage to maintain anteroposterior diameter.

COMPLICATIONS

In general, laryngofissure is associated with low morbidity; most of the complications encountered during this operation are the result of the endolaryngeal surgery and not the approach itself. The most common complication after thyrotomy is webbing of the anterior commissure. Significant webbing is usually the result of faulty technique, such as failure to reapproximate the cords to the anterior edge of the thyrotomy or bilateral injury to the mucosa of vocal folds.

Failure of the thyrotomy to heal is rare and most common in patients with compromised blood supply, such as those with small-vessel disease (e.g., diabetes mellitus), those who have previously undergone radiation therapy, and those with disorders associated with delayed healing (e.g., Cushing's disease). Other important causes of nonhealing are the presence of a foreign body or residual tumor.

Most cases of nonhealing of a thyrotomy are associated with a laryngocutaneous fistula. A laryngocutaneous fistula may be treated with local care and observed for a reasonable period (2 to 3 weeks). During this time the patient is maintained on clear liquids, and supplemental enteral nutrition is continued via a silicone nasogastric tube. This therapeutic approach will be successful in most patients.

If the problem persists, the endolarynx should be evaluated by direct laryngoscopy to assess the possibility of a tumor or foreign body at the thyrotomy site. Stable plate fixation may be preserved even in the presence of a laryngocutaneous fistula. If the plate is unstable, it should be removed because it becomes a nidus for bacterial growth. The laryngeal cartilage depends on the perichondrium for its blood supply. Denuded cartilage exposed to the lumen of the airway behaves as a foreign body and should be débrided.

Malunion of the thyrotomy may cause glottic insufficiency because of healing of the vocal cords at different levels. Failure to re-establish the natural angle of thyroid cartilage results in poor voice. This is unusual if the cartilage is carefully reapproximated, especially after using a miniplate fixation technique with preplating. This problem is corrected by repeat thyrotomy and repositioning of the thyroid alae.

PEARLS

- Laryngofissure provides a versatile approach to a variety of diseases of the endolarynx, including benign and malignant tumors, vocal fold paralysis, laryngeal trauma, and laryngeal stenosis or webs.

- Patients with anatomy that is unfavorable for endoscopic approaches are excellent candidates for laryngofissure.
- Preplating the thyroid alae minimizes the likelihood of malunion and its associated complications.
- When laryngofissure is performed for malignant tumors, preoperative imaging is essential to rule out cartilage invasion and other contraindications to this approach.
- Laryngofissure is considered “clean-contaminated” surgery, and perioperative antibiotics should be used to prevent wound infection.

PITFALLS

- Failure to perform a tracheostomy before the laryngofissure provides suboptimal exposure of the endolarynx during surgery and a potentially unstable airway postoperatively.
- Inadequate resuspension of the anterior margin of the vocal cords at the anterior commissure may result in an anterior glottic web, shortening of the vocal folds, and poor voice quality postoperatively.
- A laryngocutaneous fistula generally results from malunion of the thyroid cartilage but often resolves with conservative therapy.
- Failure of a postoperative laryngocutaneous fistula to heal may indicate the presence of residual tumor, infection, or a foreign body.
- Recurrent respiratory papillomatosis is a contraindication to laryngofissure because it may result in dissemination of disease in the neck.