

Chapter 71 – Management of Tracheocutaneous Fistula and Depressed Scar

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A tracheocutaneous fistula is a sequela of tracheotomy and is usually associated with an unsightly depressed tracheotomy scar. Formation of this fistula is predicated on squamous epithelium migrating from the skin into the trachea, forming an epithelial interface with the mucosa of the trachea, and thereby creating a true fistula that cannot close spontaneously. Marked separation of the strap muscles associated with a prolonged indwelling cannula, infection, and wasting of subcutaneous tissue are important factors predisposing to the development of a depressed scar and fistula. These features facilitate epithelial migration toward the tracheal mucosa along the tract formed by the tracheostomy cannula. The relationship between the duration of tracheostomy and the development of a persistent fistulous tract has been well established, with a fistula rate of 50% being identified in patients with a cannulation time of longer than 1 year.^[1,2]

Persistence of a tracheocutaneous fistula may lead to increased morbidity, particularly in children with limited pulmonary reserve. White and Smitheringale have listed “pneumonia or even drowning occurring as a result of aspiration of liquid through the fistula particularly while the infant is bathing. Mucus and saliva expelled from the trachea can present a hygiene problem and an embarrassing social situation. Lastly, if of sufficient size, the persistent tracheocutaneous fistula may interfere with the child's speech.”^[3]

A persistent tracheocutaneous fistula may also contribute to reduced pulmonary function in patients with underlying pulmonary disease.^[4] Eaton and colleagues^[5] stated that a persistent tracheocutaneous fistula in children may be a source of considerable morbidity because of problems with poor hygiene, aspiration, respiratory infection, and associated speech difficulty.

In addition to problems with the fistula, wide, unsightly scars often follow tracheostomy as secondary healing occurs after decannulation. Many emergency tracheostomies are still carried out through a vertical incision, which itself may result in an unsightly scar or a keloid.

Closure of a tracheocutaneous fistula was reported as early as 1934 by Jackson and Babcock.^[6] They used a lined bipedicle flap reinforced with conchal cartilage. Pressman reported repair of a depressed tracheostomy scar by detaching and transposing the origins of the sternocleidomastoid muscle into the defect.^[7] Bishop and coworkers suggested rotation of the sternohyoid muscle and closure of the stoma with a turnover flap of skin based at the inferior margin of the tracheostomy site.^[8] Lewis and colleagues described the use of a subcutaneous Z-plasty in which fat and platysma muscle were incorporated to provide additional soft tissue bulk and to take tension off the suture line.^[9]

During performance of a tracheostomy, the strap muscles are retracted laterally and the cannula is inserted. In a patient who has had a cannula in place for a prolonged period, infection and fibrosis occur and the strap muscles are scarred into a position lateral to the tracheotomy. When the patient is eventually decannulated and the stoma heals by secondary intention, the skin heals directly to the trachea, thus forming a depressed scar without a tracheocutaneous fistula.

Several methods for closure of a tracheocutaneous fistula have been described, including primary closure, fistulectomy with primary closure in layers, and fistulectomy with healing by secondary intention. The use of electrocautery in the management of fistulas in the pediatric group has been described.^[5] When a fistula is too large to be closed by secondary intention, a secondary surgical procedure is necessary. Lee and associates described closure of a large tracheocutaneous fistula with a turnover hinge flap and a V-Y advancement flap in two patients who had undergone tracheostomy during conservation partial laryngectomy.^[10]

Our technique emphasizes restoring the natural anatomic position of the strap muscles in the midline. This key feature has eliminated the need for the aforementioned procedures. Kulber and Passy described a similar technique that prevents reattachment of the skin to the trachea by reapproximation of the strap muscles in the midline.^[11]

White and Smitheringale suggest that epithelial migration of skin into the trachea and extensive cicatricial resolution of chronic granulation tissue result in the formation of a dense connective tissue sleeve based around the entire opening of the tracheal stoma. They state that “this condition is responsible for difficult tracheotomy changes, decannulation problems and aphonia in children.”^[3] It has been stated that intraluminal extension of this tracheal keloid may easily be underestimated during bronchoscopy; therefore, more recent recommendations for surgical

management include complete revision of the tracheostomy sinus tract, followed by either decannulation or closure of the tracheostomy.^[12] White and Smitheringale suggest several methods of closure of the tracheostomy site in children.^[3] In one, the fistula is excised, the base is closed in pursestring fashion and inverted into the fistulous tract, and the wound is closed in two or three layers with or without closure of the strap muscles in the midline. The fistulous tract and scar are sharply excised down to the level of the tracheostoma, including any intraluminal component. The trachea is then closed with silk or sometimes wire, followed by a three-layer closure of the strap muscles, subcutaneous tissue, and skin. They also describe a procedure involving excision of the epithelialized tract, including any intraluminal extension noted at bronchoscopy, followed by temporary replacement and early removal of a small tracheotomy tube.

PATIENT SELECTION

Patients selected for this procedure usually have had tracheostomy cannulas in place long-term. After decannulation, an unsightly depressed scar is fixed to the trachea and moves every time that the patient swallows. Such movement may occur with or without a fistulous tract (Fig. 71-1). Children with pneumonia or aspiration of liquid through the fistula are certainly examples of those who would benefit from this procedure. Discharge of mucus and saliva from the trachea presents a problem with hygiene and is a source of embarrassment to old and young alike. Patients with a tracheocutaneous fistula, particularly children, will find that their voice will be stronger after closure of the fistula.



Figure 71-1 A tracheocutaneous fistula resulted from long-term placement of a tracheostomy cannula.

PREOPERATIVE PLANNING

Complications may occur after closure of a tracheocutaneous fistula, particularly in children, so it is of utmost importance to ensure that the caliber of the trachea is satisfactory before closure. One reason for persistence of the fistula may be that the patient does not have an adequate airway and the fistula serves as an auxiliary airway. The concern is that once the fistula is closed in such patients, the airway might not be patent enough to permit adequate air exchange.

The airway should always be evaluated before closure of a tracheocutaneous fistula to ensure an adequate lumen. Laryngoscopy and tracheoscopy are appropriate techniques for such evaluation. Particular attention should be

directed to the superior aspect of the stoma because this area is the most common site of granuloma formation, which may occlude the airway in children. In adults, simple closure of the fistula should not interfere with the airway. Computed tomography is an alternative approach to evaluate the adequacy of the tracheal lumen, particularly if closure under local anesthesia is being contemplated.

SURGICAL TECHNIQUE

In adults, the fistula may be excised and the scar revised in a single-stage procedure under local anesthesia with intravenous sedation. The patient is placed in the supine position with the head extended. A transverse incision is made at the level of and extending somewhat lateral to the tracheocutaneous fistula (Fig. 71-2). The skin flaps are widely undermined. The scar between the skin and the fistula should then be released. Dissection is carried down along the fistula to the level of the trachea. The tract should then be excised, with just enough skin left to close the fistula by inverting the squamous epithelium so that it forms the inner epithelial surface of the anterior wall of the trachea (Fig. 71-3).

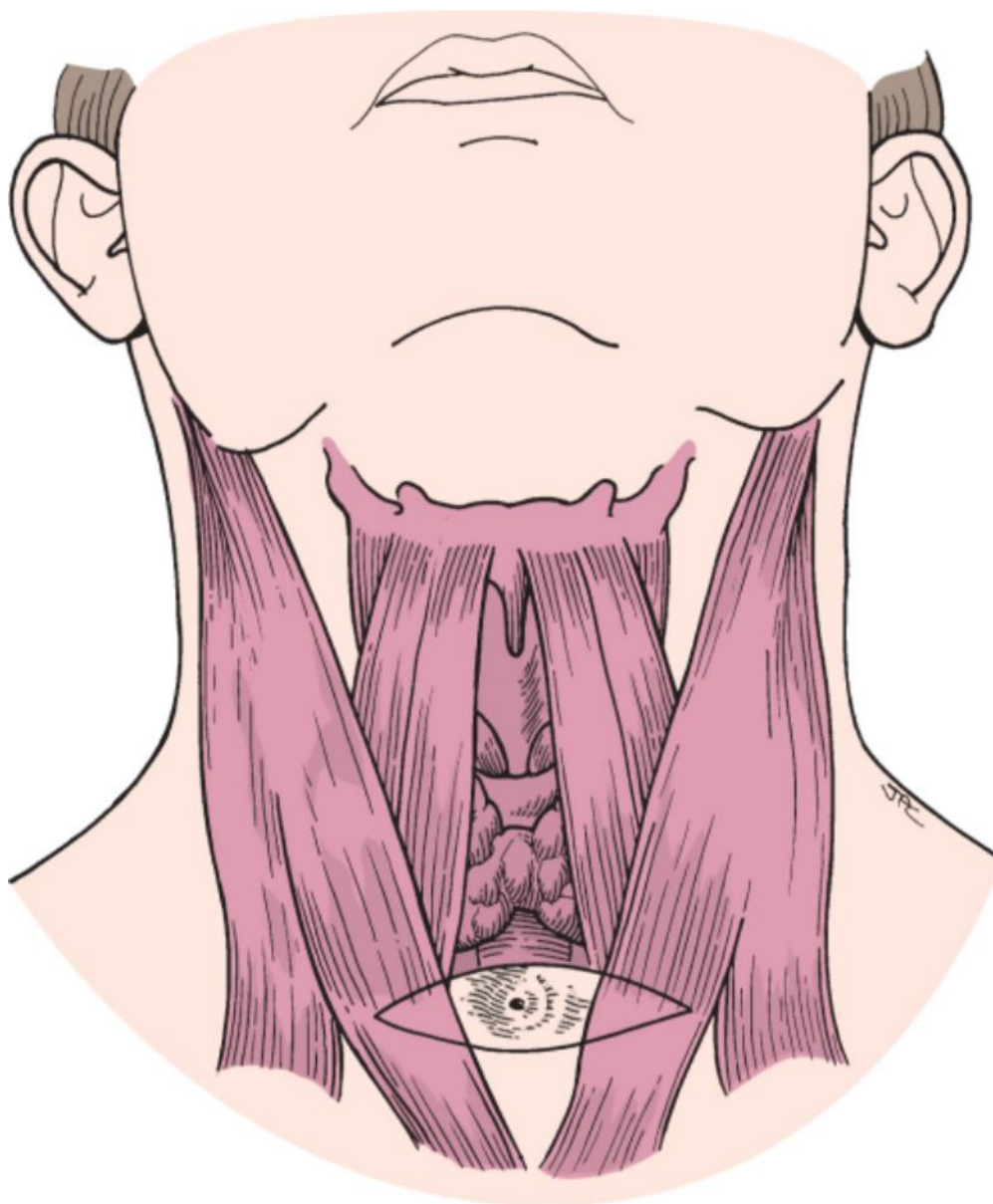


Figure 71-2 The scar from the tracheotomy is excised almost down to the fistula.

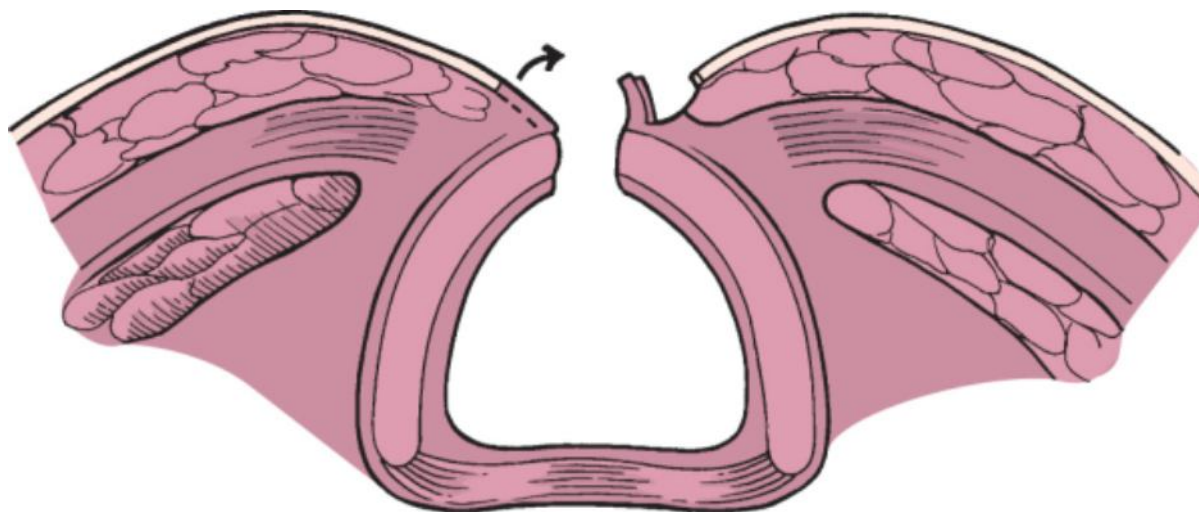


Figure 71-3 Dissection is carried down to the surface of the fistula, and the skin of the fistulous tract is used as a skin flap. It is turned in to restore the anterior epithelial lining of the trachea.

The strap muscles will be found incorporated in dense scar tissue and adherent to the lateral aspect of the trachea. The strap muscles are then dissected free from the scar tissue (Fig. 71-4) and repositioned over the trachea to restore them to their normal anatomic position. The muscles are next sutured together in the midline with absorbable suture (Fig. 71-5). This maneuver effectively separates the trachea from the skin and prevents reformation of the depressed scar. The subcutaneous tissue is closed without tension. The skin incision is then closed with 6-0 chromic suture. A Z-plasty or a geometric broken-line skin closure may be used if necessary to produce a small, smooth scar. Steri-Strips rather than a dressing should be applied to the wound to minimize tension.

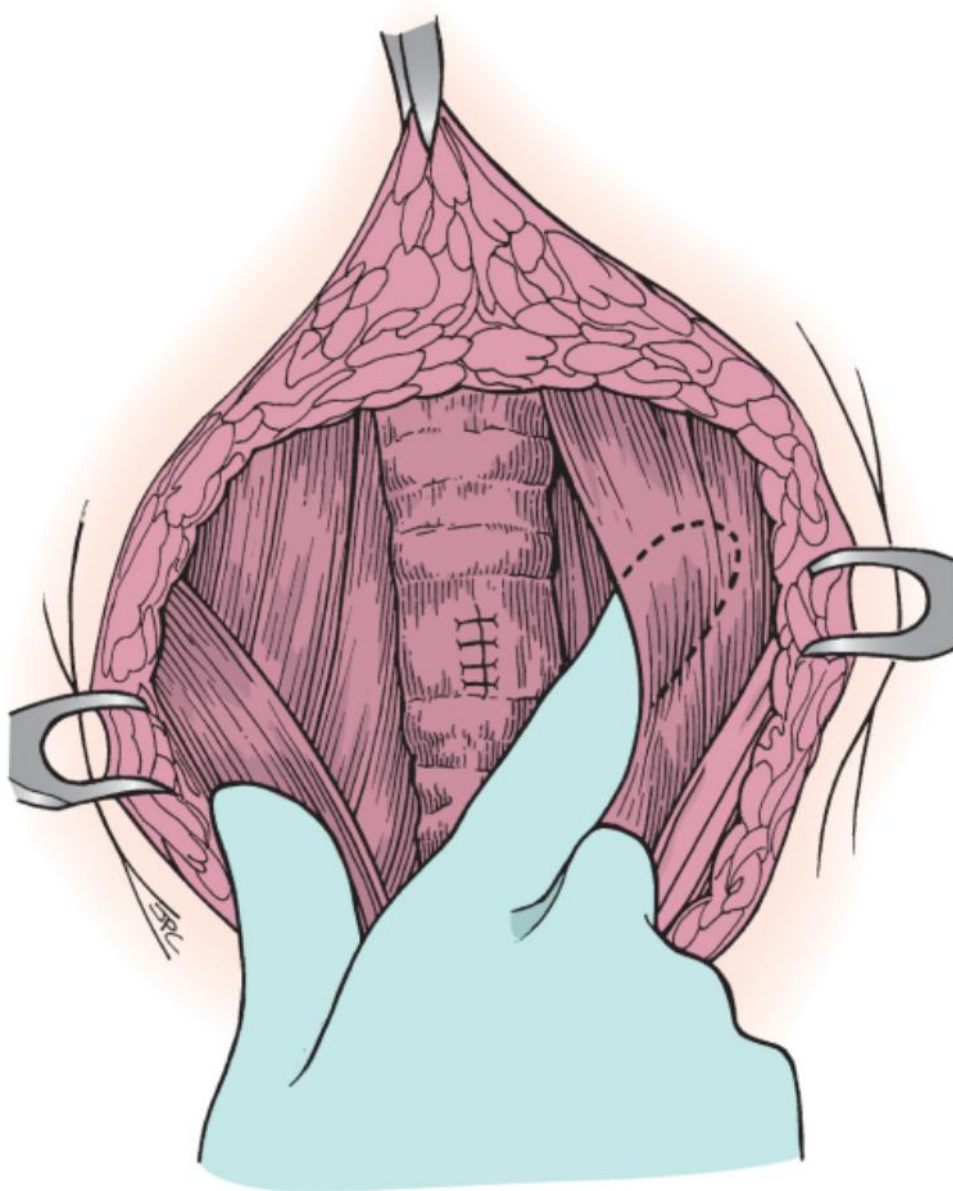


Figure 71-4 The skin flaps superior/inferior to the incision are undermined, and the strap muscles are dissected free of the trachea.

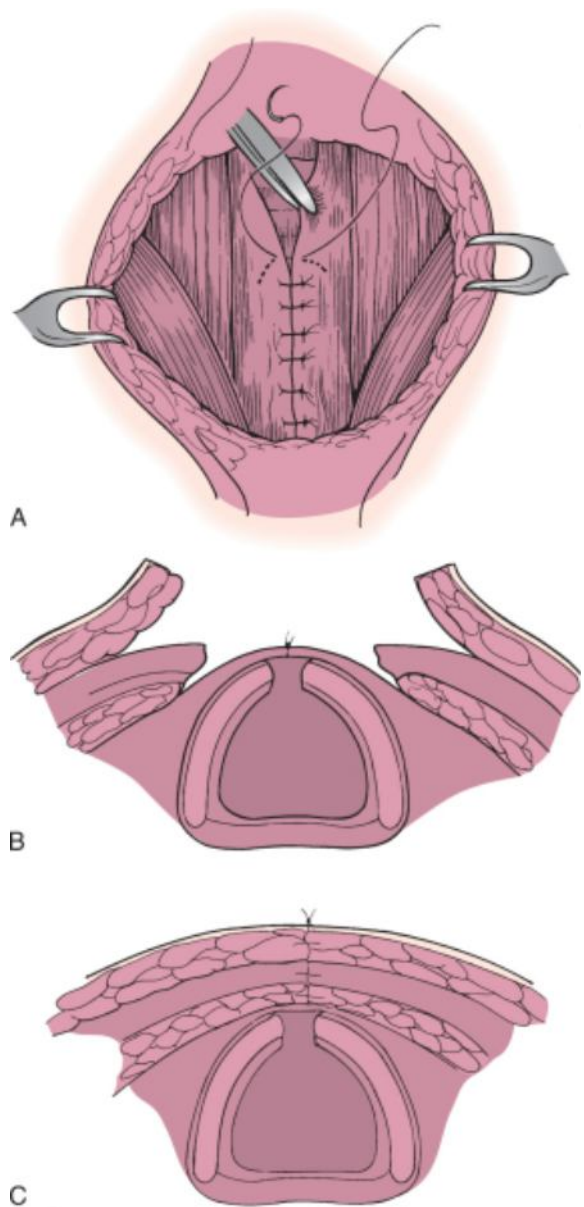
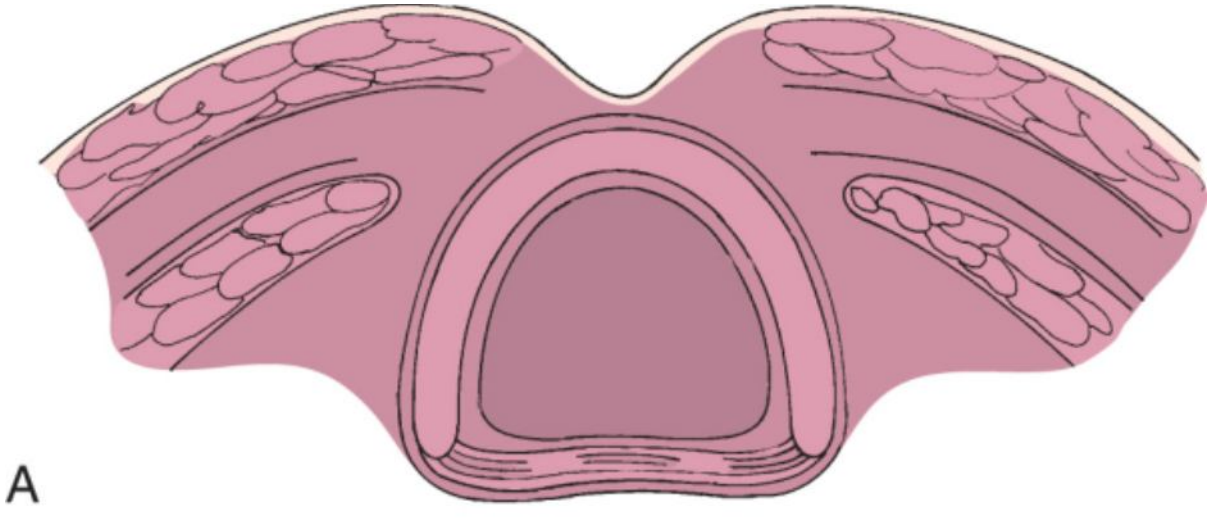
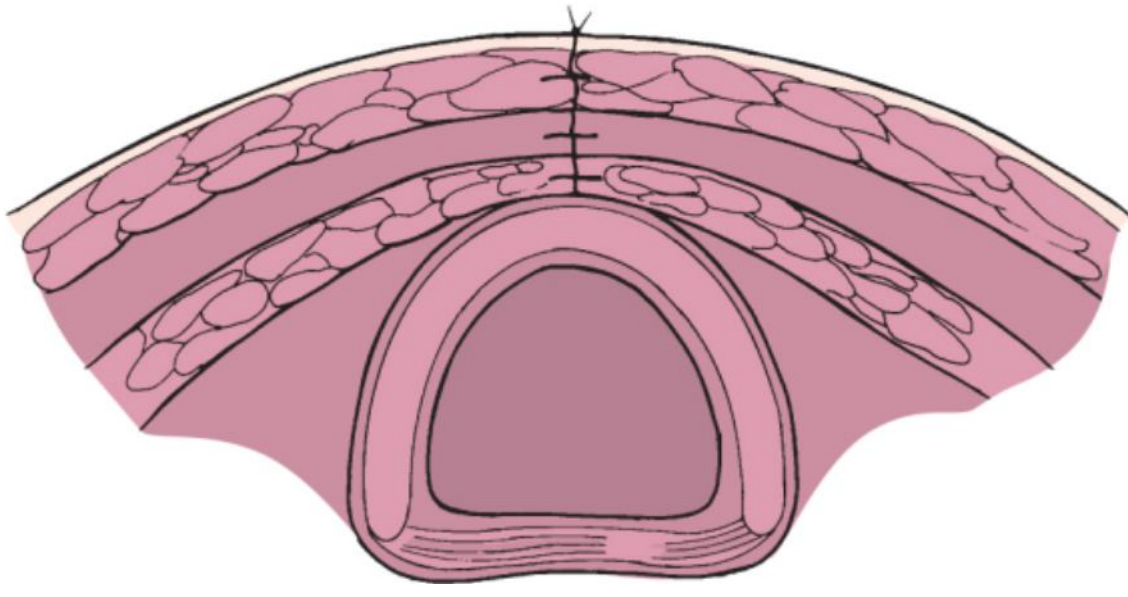


Figure 71-5 A to C, The strap muscles are repositioned in the midline and sutured together. The subcutaneous tissue and skin are then closed.

A modification of this technique is also used for patients who have a depressed tracheotomy scar without a tracheocutaneous fistula (Fig. 71-6). The mechanism of the depressed scar with adherence to the trachea is similar; of course, the only step that is unnecessary is excision of the fistula. The procedure results in an acceptable scar (Fig. 71-7). Returning the strap muscles to their anatomic position eliminates the depressed scar and prevents its recurrence.



A



B

Figure 71-6 A and B, The depressed scar, without a fistula, is managed in similar fashion.



Figure 71-7 The improved cosmetic result after excision of the tracheocutaneous fistula (A) and revision of the depressed scar (B).

Potential complications of repair include pneumomediastinum, pneumothorax, and respiratory insufficiency requiring tracheotomy.^[13] Complications occurred in patients who underwent single-stage excision and closure of the tracheocutaneous fistula associated with large defects of the anterior tracheal wall. The authors therefore modified their technique for larger defects as follows. The tracheocutaneous fistula and scar are excised by means of a horizontal elliptical excision. The fistulous tract is dissected down to the anterior tracheal wall and divided. If the defect in the anterior wall is greater than 4 mm, a no. 3 or 4 metal Pilling tracheotomy tube is inserted into the previous tracheotomy site. The strap muscles are elevated and closed in the midline around the tracheotomy tube with 4-0 polyglactin. The skin edges are widely undermined and then closed around the tracheotomy tube with 5-0 nylon suture. The tracheotomy tube is plugged in the recovery room or on the first postoperative day and the patient decannulated on day 2. The small central area is allowed to heal by secondary intention.

In children, this procedure is done under general anesthesia by using the least complex method of closing a tracheocutaneous fistula, which consists of excising the epithelium of the fistulous tract and allowing the tract to close by secondary intention. Such closure occurs rapidly and results in a watertight seal that will allow the patient to swim and bathe. This method is recommended for young children in particular because more extensive procedures may require lengthy anesthesia and manipulation of the trachea may lead to edema and airway obstruction. If the scar is not satisfactory, it may be revised later.^[14]

POSTOPERATIVE MANAGEMENT

Perioperative antibiotics are administered to prevent infection because the fistula is colonized by potentially

pathogenic organisms. Adult patients are usually hospitalized overnight for observation of the airway and discharged the next day. Care of the wound is minimal because the skin is closed with absorbable 6-0 catgut skin sutures and Steri-Strips, which are removed in 7 to 10 days. Typically, no further wound care is required. Infants or children who undergo this procedure are best monitored in an intensive care unit overnight to ensure adequacy of the airway. A tracheotomy set should be kept at the bedside in the event of airway obstruction.

COMPLICATIONS

We have not experienced any complications in adult patients undergoing this procedure. There are numerous reports, however, of children who have undergone this closure only to have airway distress that has resulted in severe complications and required reopening of the wound to establish an airway.

Wheeler and associates described four patients, the eldest of which was 31 months of age, who experienced severe respiratory distress within 24 hours of primary closure of the fistula and who required emergency care.^[15] These patients had pulmonary disease and appeared to be at increased risk because of high transmural airway pressure with forceful coughing. The authors also call attention to the potential for pneumopericardium or pneumoperitoneum in addition to the subcutaneous emphysema that they noted.

Keenan and coworkers also reported four cases, the first two of which illustrate the complications that might arise with primary closure of the fistulous tract.^[16] In their first patient, a problem arose when they attempted to obtain an airtight, watertight seal with meticulously layered closure. The airway distress experienced by this patient prompted the authors to modify their procedure to include simple excision of the fistulous tract and allow the wound to heal by secondary intention.

PEARLS

- Patients in the pediatric age group should be evaluated endoscopically to ensure that the airway is patent before closure of a tracheocutaneous fistula.
- Computed tomography may be useful in evaluating the airway before closing a tracheocutaneous fistula.
- The procedure should be done under local anesthesia with intravenous sedation in adults as a safety measure and to avoid the possibility of subcutaneous emphysema after extubation.
- The key feature of the operation is dissecting the strap muscles free of scar tissue and the trachea and restoring normal anatomy by reapproximating the strap muscles in the midline. This reinforces the closure in patients with a tracheocutaneous fistula and eliminates the depressed scar in all patients.
- Children undergoing closure of a tracheocutaneous fistula should be monitored in the intensive care unit after the procedure because airway distress may be a complication of this procedure.
- Adult patients should be observed in the hospital overnight to ensure that the airway is stable.

PITFALLS

- Patients, particularly those in the pediatric age group, may experience respiratory distress after closure of a tracheocutaneous fistula.
- Tracheocutaneous fistulas are colonized by bacteria, so perioperative antibiotics should be given to prevent infection.
- Failure to thoroughly free the strap muscles from scar tissue and the trachea and to reapproximate the muscles in the midline will result in persistence of the depressed scar.
- Failure to provide airtight closure of the fistulous tract and provision of an inner epithelial lining will result in recurrence of the fistula.