

## Chapter 72 – Stenosis of the Tracheostoma Following Total Laryngectomy

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Stenosis of the tracheostoma following laryngectomy is an infrequent but distressing complication that may occur despite meticulous attention to the construction of the tracheostoma. Stenosis usually occurs in the early months following laryngectomy but may also occur years later. Wax and colleagues defined tracheal stenosis as a narrowing of the stoma that requires the patient to wear a stent (usually a laryngectomy cannula) for longer than 3 months after surgery or requires revision of the tracheal stoma.[1] Giacomarra and associates defined tracheostomal stenosis as respiratory insufficiency at rest or during exercise or if there is difficulty in clearing tracheal secretions because of nonlaminar flow, or both.[2] Although the patient with relatively good pulmonary function may maintain adequate exercise tolerance, many patients with emphysema or chronic obstructive lung disease may encounter respiratory insufficiency[3] with stenosis of the tracheostoma. Adequate mucociliary transport may be impeded by stomal stenosis and may result in stagnation of mucus and the potential for recurrent pulmonary infection. Severe stenosis is potentially dangerous because complete obstruction may occur in the presence of crusting or a mucous plug, particularly during an episode of tracheitis or tracheobronchitis.[4] Stomal stenosis will also interfere with proper insertion and use of a tracheoesophageal puncture speech prosthesis.

### CAUSATIVE FACTORS

The following factors contribute to stomal stenosis:

- Radiation therapy
- Wound dehiscence with healing by secondary intention
- Inadequate excision of peristomal skin and fat at the time of initial stomal construction
- Devascularization of the trachea
- Infection after surgery
- Hypertrophic scarring
- Excessive scar tissue formation
- Peristomal recurrence of cancer

Prevention of stomal stenosis should be a part of preoperative planning and should include meticulous surgical technique and diligent postoperative care. Patients who have risk factors for tracheostomal stenosis need special attention to prevent this problem.

In the case of extensive resection of additional tracheal rings for adequate tumor clearance, careful construction of the tracheostoma with appropriate flap design may minimize tension and prevent tracheocutaneous dehiscence, which would ultimately lead to concentric scarring and stenosis.

Patients who have had a preliminary tracheostomy for airway obstruction days or weeks before surgery usually develop extensive local inflammatory response and colonization with bacteria in the peristomal skin. This skin and a tracheal ring below the stoma should be excised with the specimen in order to prevent postoperative infection. Patients who are markedly obese may have bulging of tissues into the stoma, resulting in a form of pseudostenosis.

Stomal stenosis may be encountered following radiation therapy, particularly when the peristomal area is included in the radiation portal, such as in patients with subglottic extension of cancer who are at risk for stomal recurrence. Local flap transposition may help prevent this concentric scar formation and, ultimately, prevent stenosis.

The primary objectives in the prevention of tracheostomal stenosis are related to surgical technical aspects such as careful approximation of skin and mucous membrane, elimination of extensive compressive forces and active tension on the stoma margin, increasing the diameter of the stoma, and redistribution of the forces of scar contraction.[5]

The following are technical modifications:[4,6–8]

- Oblique section of the tracheal stump to increase stomal diameter, therefore forming an oval rather than a circular stoma
- Excision of peristomal fat

- Complete skin coverage of the cut edge of the tracheal cartilage with through-and-through or vertical mattress sutures

Clairmont,<sup>[9]</sup> Jatho,<sup>[10]</sup> Isshiki and Tanabe,<sup>[11]</sup> Trail and colleagues,<sup>[12]</sup> and Hartwell and Dykes<sup>[13]</sup> describe a variety of similar techniques using Z-plasty, double-V, and V-Y flap design methods of primary tracheostomal construction at the time of laryngectomy, thereby enlarging the stoma and redirecting the forces of scar contraction. Vlantis and associates described a method of primary reconstruction of the stoma designed to prevent stomal stenosis.<sup>[14]</sup> They had a series of 260 patients over a 10-year period, only 6% of whom developed a stenosis of the stoma. Interestingly, 76% of the patients had prior radiation therapy and 73% received a vocal prosthesis at the time of surgery. Their technique was said to be simple and makes best use of the natural supportive function of tracheal cartilage and basic surgical principles.

Postoperatively, when tracheostomal stenosis has developed, it may be managed by conservative means or by surgical correction. The nonsurgical technique involves dilatation with progressively larger laryngectomy tubes and constant use of one of a variety of tracheostomy stents. This may not be satisfactory in some patients, because removal of the tube or button, for even a few hours, may result in rapid restenosis. In patients who have been heavily irradiated, however, this form of management may be useful, because surgical management of heavily radiated tissues may predispose toward loss of surrounding skin and restenosis. An additional drawback to stenting with a stoma button is that the presence of a tracheotomy valve or button may preclude the use of the valve in patients with a tracheoesophageal puncture.

Sani has described the CO<sub>2</sub> laser stomaplasty for tracheostomal stenosis.<sup>[15]</sup> This technique includes ablating a triangular area on each side of the tracheostoma. The areas ablated include the rim of the stoma. These denuded areas then heal by secondary intention. The procedure had to be repeated in three out of eight patients in this series. Seven of eight patients eventually attained a satisfactory stoma that did not require cannulation.

Bretteville and associates reported a series of 20 consecutive patients with stenosis of the tracheostoma following total laryngectomy.<sup>[16]</sup> The authors described their experience with 280 laryngectomies with an incidence of stenosis of 7%. Their technique is based on the principle of multiple Y-V plasties, usually under local anesthesia. They incised previous scars and created small pointed skin flaps that are aligned with tracheal incisions. No tissue is removed and all of the denuded area is covered by skin or mucosa.

Numerous authors have reported their methods of revision of the tracheostoma. Montgomery<sup>[4]</sup> classified the common types of stenosis as (1) vertical slit, (2) concentric, and (3) inferior shelf. He described separate procedures for the correction of these individual problems. Converse<sup>[17]</sup> and Maruyama and colleagues<sup>[18]</sup> also described variations of the Z-plasty technique for this problem. Giacomarra and associates described a technique for the correction of tracheostomal stenosis, combining radial incisions, V-shaped flaps, and interposing flaps.<sup>[2]</sup> Wax and colleagues, in a series of 43 patients with tracheostomal stenosis, used a variety of techniques including advancement flaps, Z-plasties, and V-Y inseting.<sup>[19]</sup> All three of these techniques had a greater than 90% success rate when used primarily. One of these 11 failed patients had a successful revision using one of the other techniques.

## **PATIENT SELECTION**

Patients who develop postoperative stomal stenosis are usually given a trial of treatment using plastic stents or laryngectomy tubes. This procedure involves the use of an uncuffed tube that fits snugly into the stenotic stoma. After wearing the tube for approximately 1 week, the patient returns to have the next larger tube inserted. This progressive gentle dilatation continues until the patient has a caliber matching that of the no. 8 laryngectomy tube. The patient should wear a tube constantly for 6 months. During the day, a soft silastic stent with the posterior aspect fenestrated makes it possible to use the speaking valve. If the patient has an adequate airway at that time, then no surgery is required. However, if the stoma restenoses, then the patient should be given the option of having surgical intervention. Patients who have had very high doses of radiation to the stoma should be managed conservatively, if possible, because radiation interferes with healing and predisposes to tissue loss and restenosis. Every effort should be made to rule out peristomal recurrence of cancer.

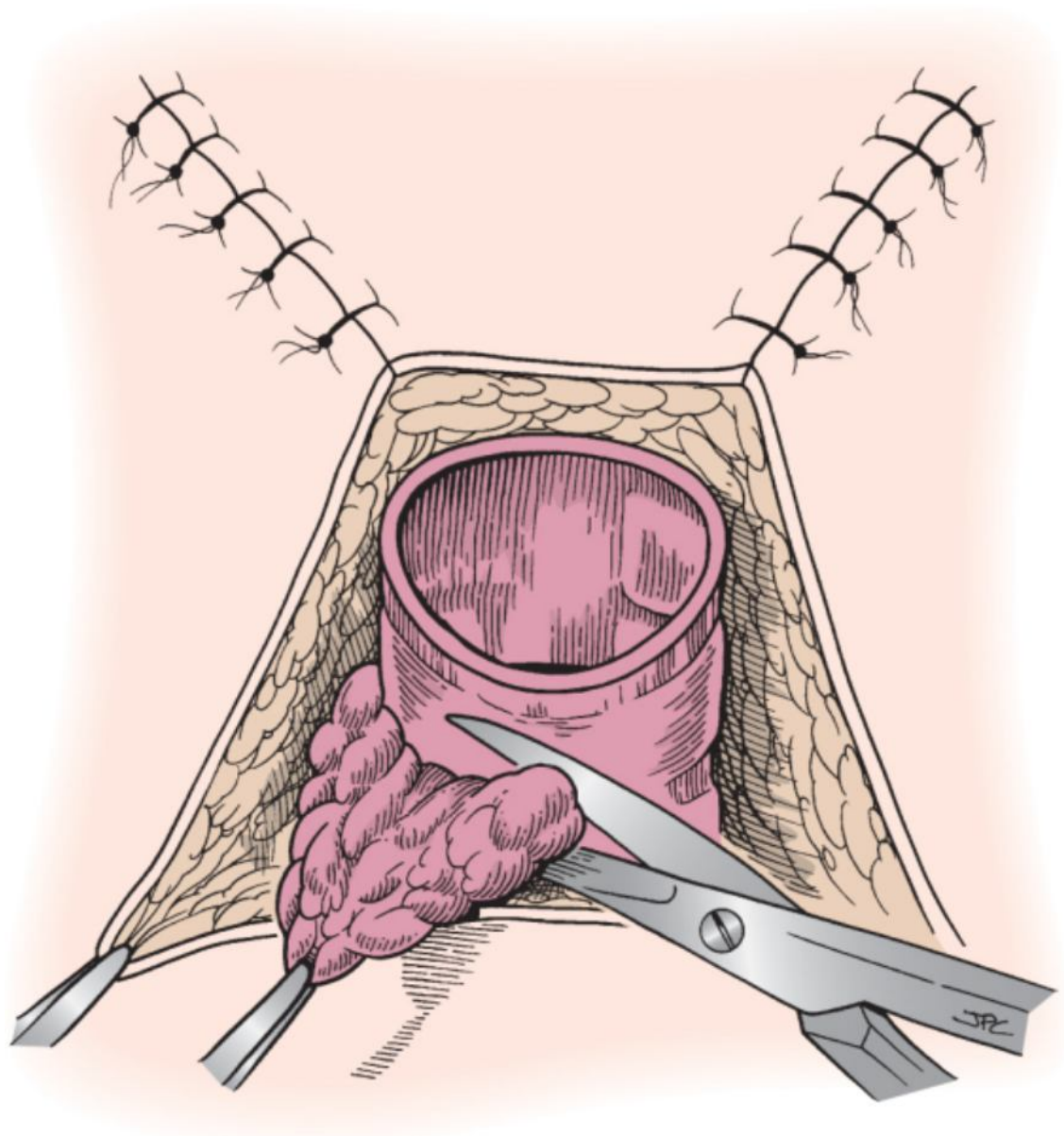
## **SURGICAL TECHNIQUE**

The forces of scar contracture predispose to stenosis in healing of a circular wound. The most common problem producing stenosis is a band of scar tissue that concentrically narrows the stoma (Fig. 72-1). The caliber of the trachea inferior to the scar band is usually normal. The goals of the revision procedure are to excise the concentric scar and prevent it from recurring. The common features for all techniques are (or should be) (1) to eliminate circular forces of contraction and (2) to provide for healing by primary intention (e.g., skin-mucosa).

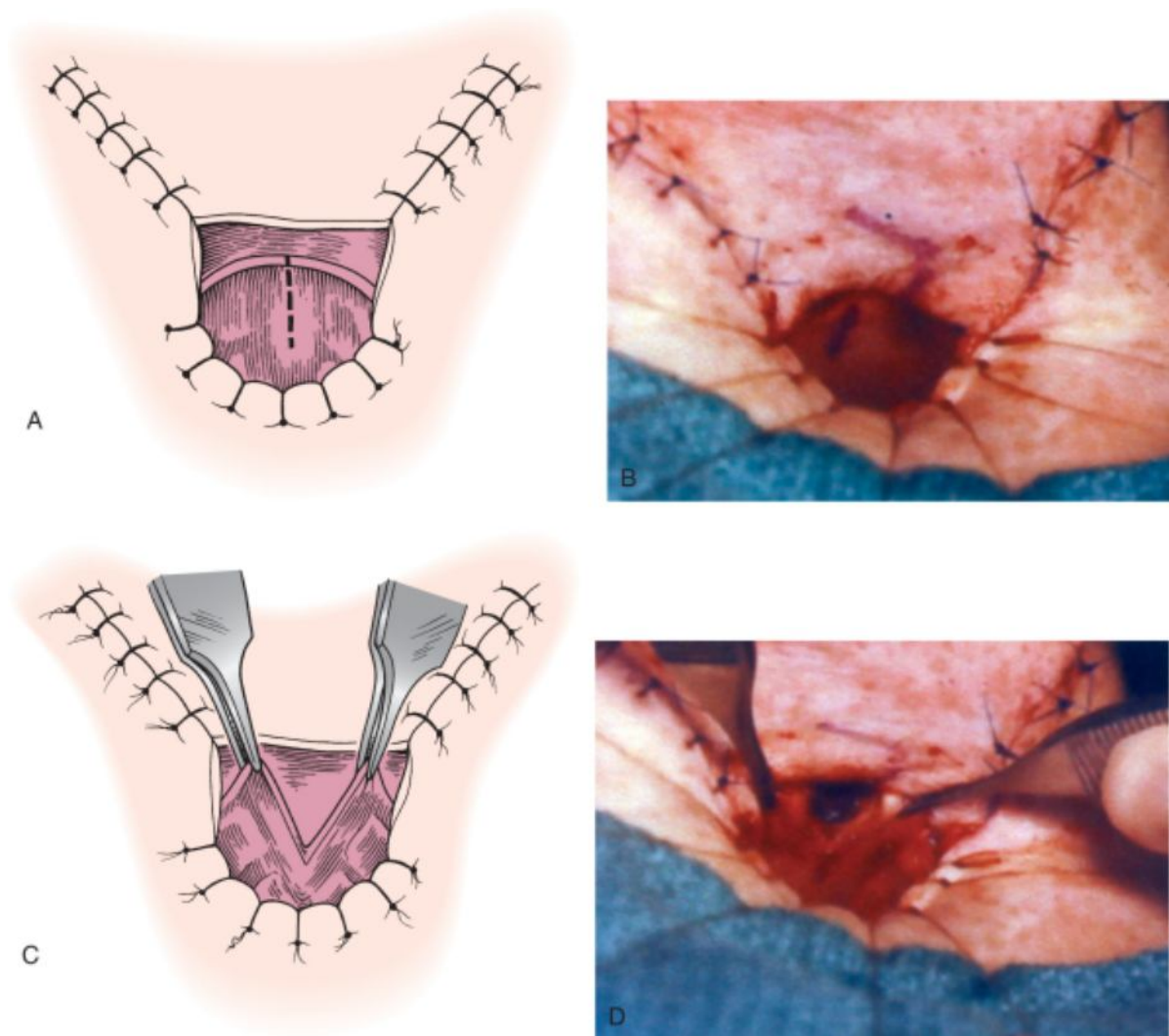


**Figure 72-1** Tracheostomal stenosis.

The operation may be done with the patient under local or general anesthesia. A rolled-up blanket is placed under the patient's shoulders to provide extension. An incision is made around the periphery of the tracheostoma and the band of scar tissue. Clamps are applied to the scar tissue band, and the trachea is pulled up into the wound. The trachea is skeletonized 1 to 2 cm inferior to the stoma, thereby allowing repositioning of the trachea. The skin inferior to the tracheostoma and overlying the sternum is undermined approximately 2 to 3 cm, and the subcutaneous tissue and adipose tissue are excised. The excess skin in this area should also be excised in order to provide some tension on the inferior aspect of the tracheostoma, promoting widening of the stoma. The band of scar tissue is then excised (Fig. 72-2). The tracheostoma and the surrounding skin are sutured to the trachea using interrupted 3-0 chromic catgut sutures with meticulous technique that ensures that the skin overlaps the raw edges of the cartilage and is in contact with the tracheal mucosa. This suturing is carried out as far as 3 and 9 o'clock on the tracheostoma. The skin of the neck surrounding the posterior wall of the trachea is then undermined, and adipose tissue and redundant skin are excised. The membranous posterior wall of the trachea is then incised vertically, approximately 1 cm into the trachea itself in order to expand the size of the lumen (Fig. 72-3). The suturing of the trachea to the skin inferior to the trachea is resumed.

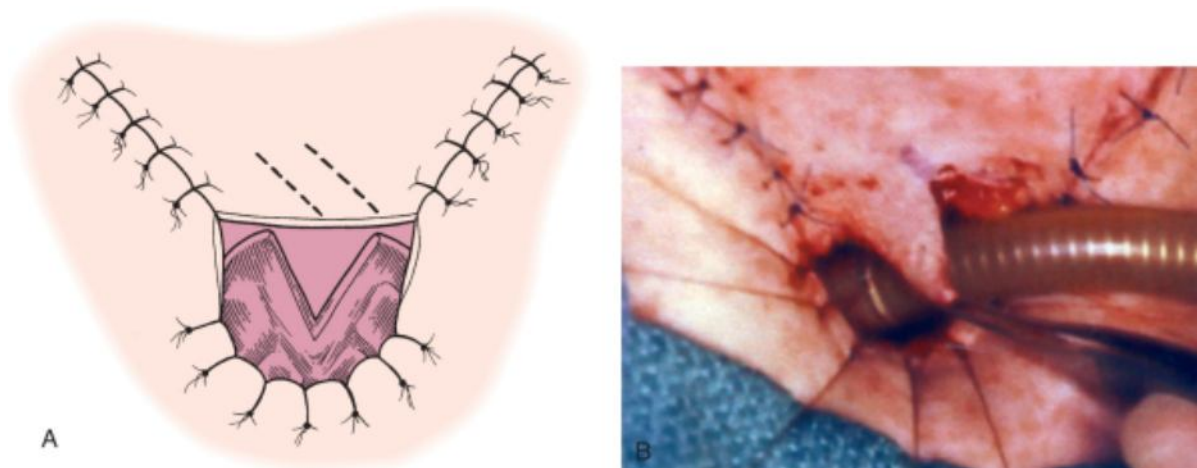


**Figure 72-2** Excision of the peristomal skin and adipose tissue.

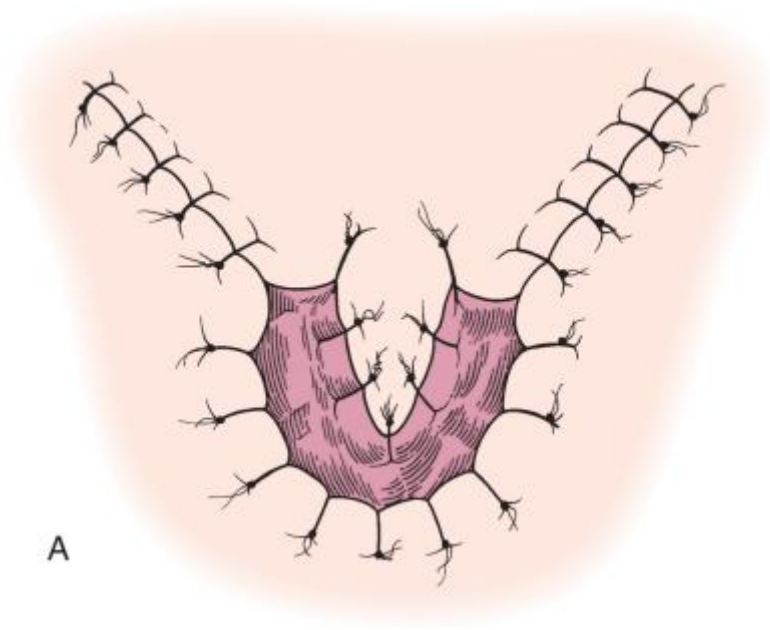


**Figure 72-3** A and B, An incision is made in the posterior wall of the trachea. C and D, The defect is opened.

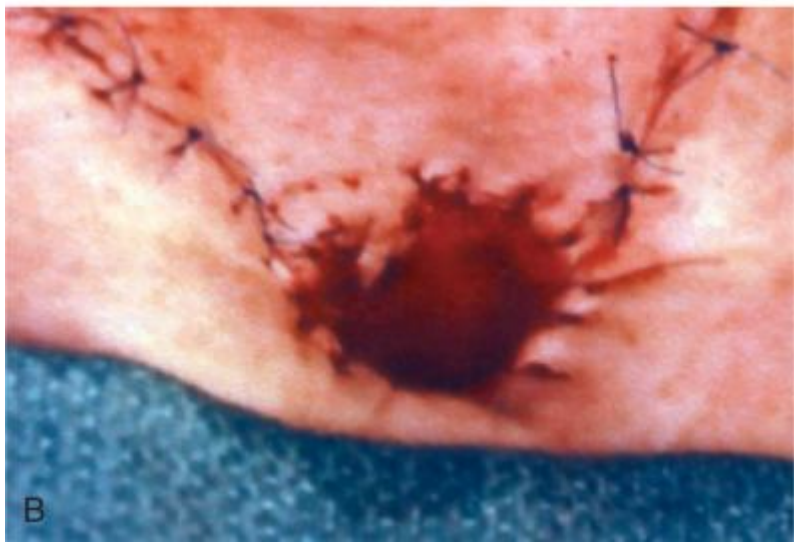
At this point, the circumference of the tracheostoma is considerably widened, because the trachea has been split and the tracheal lumen spread open. A small incision is made in the redundant skin posterior to the trachea so that a small skin flap is developed (Fig. 72-4). The flap is then transposed, inset, and sewn into the incision in the posterior tracheal wall using 3-0 chromic catgut suture (Fig. 72-5). The introduction of the flap is a modified Z-plasty, which breaks up the circle, preventing future stenosis, and is the single most important aspect of this technique (Fig. 72-6).



**Figure 72-4** A flap is formed from redundant skin posterior to the trachea.

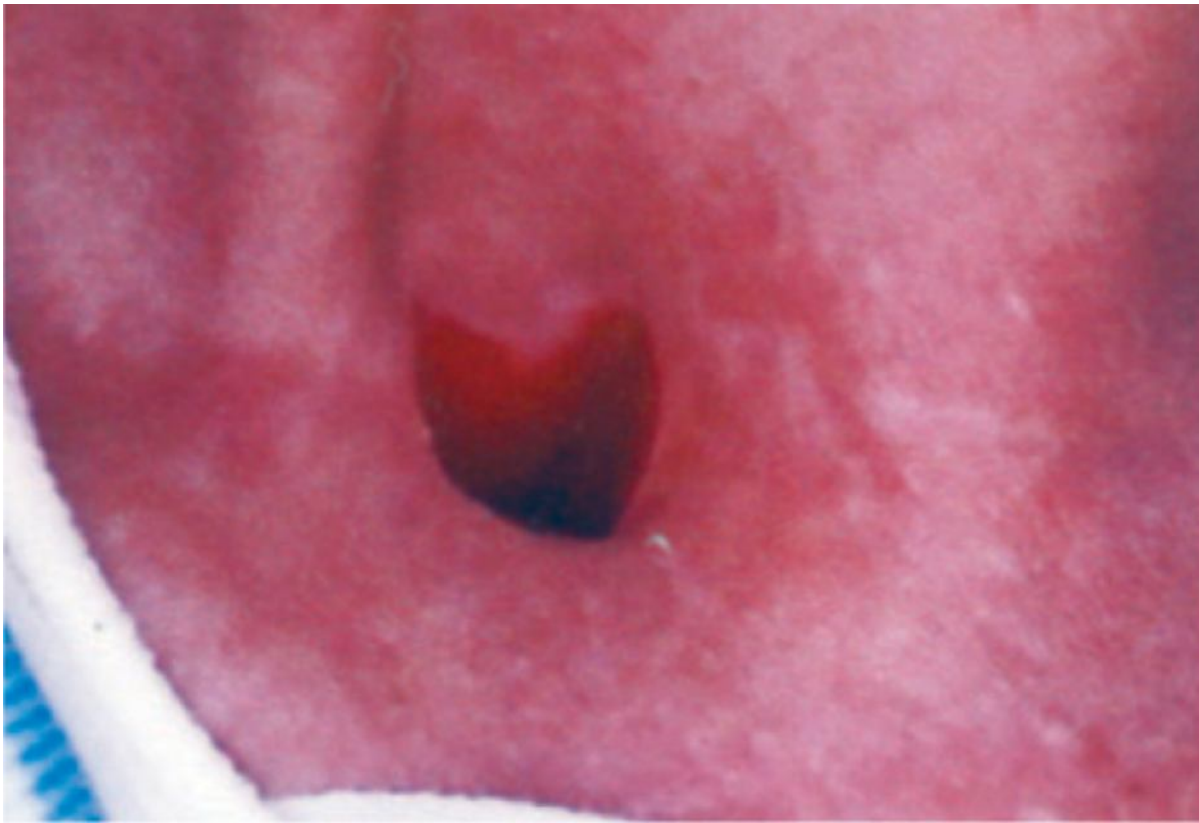


A



B

**Figure 72-5** The skin flap is transposed into the tracheal incision and inset, and the stomal skin closure is completed.



**Figure 72-6** Stomal revision using a skin flap.

This technique may be used at the time of the total laryngectomy procedure. It is of particular importance to anticipate the potential for tracheostomal stenosis in patients who are to receive postoperative therapy in which the portal includes the stoma and the superior mediastinum. This technique, however, may interfere with placing an immediate tracheoesophageal puncture. In these cases, the same technique as previously described can be performed with the flap based inferiorly and inset into an incision made in the inferior aspect of the trachea through the cartilaginous rings.

### **POSTOPERATIVE MANAGEMENT**

The patient should keep the peristomal area clean and free of crusts in the immediate postoperative period by using hydrogen peroxide on cotton applicators. Following the application of the hydrogen peroxide every several hours, an antibiotic ointment should be applied to this area. This should continue for several weeks until the catgut sutures have absorbed and the tracheostoma is healed.

Following complete healing, the patient should wear the laryngectomy tube only at night during sleep and should leave it out during the remainder of the day unless there appears to be some shrinkage of the stoma, in which case, the laryngectomy tube should be worn for a longer period of time.

### **COMPLICATIONS**

Loss of skin may occur in patients who have received high-dose radiation in the peristomal area. Radiation is a relative contraindication to this procedure in such cases. Serial dilatation of the trachea by the insertion of increasing-diameter laryngectomy tubes is the preferred treatment in these patients.

#### **PEARLS**

- All efforts should be made to prevent stomal stenosis by:
  - Gentle handling of tissue
  - Incorporation of the stoma into the laryngectomy incision
  - Careful approximation of skin to mucosa
  - Elimination of compression forces and active tension on the margin of the stoma
  - Ensuring an adequate diameter to the stoma

- Patients with tracheal stoma stenosis should receive a trial of conservative treatment of their problem using a laryngectomy tube or a plastic stent.
- The possibility of recurrent cancer causing stenosis should be ruled out by careful inspection, imaging, and/or biopsy.
- The technique used should be as simple as possible and be consistent with accepted surgical principles.

#### PITFALLS

- Recurrent cancer may cause narrowing of the tracheal stoma. This possibility should be ruled out before proceeding with revision surgery.
- Dilatation of the stoma with stents or a laryngectomy tube may be a good solution to the problem of stomal stenosis and the stoma should not be revised before a trial with dilatation, especially in the irradiated patient.
- The technique should be kept simple and the limited blood supply of the peristomal skin should be respected.
- Patients who have received radiation to the stomal area should not be considered candidates for revision of tracheal stenosis because of the probability of poor healing and restenosis.
- Poor nutrition leads to poor wound healing. Therefore the nutritional status of the patient should be optimized before surgery in order to maximize successful healing of the operated tissue.

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