

# Suction Drain Management of Salivary Fistulas

Robert W. Bastian, MD; Albert H. Park, MD

Salivary fistulas remain an unpleasant complication of upper aerodigestive tract surgery. To avoid a disastrous outcome such as carotid rupture, clinicians "medialize" (*i.e.*, incise the skin flap in the anterior aspect of the neck and insert a Penrose drain) to divert fistula fluid from the carotid sheath and then perform laborious wound care. Meanwhile, patients endure the unpleasant odor, discomfort due to the wound dressing, occasional secondary surgical procedures, a lengthened hospital stay, and increased financial costs.

In an effort to mitigate these problems, suction drains that had been placed at the time of the original surgical procedure were used as an alternative fistula management technique. Out of a population of 118 reviewable patients who underwent standard or extended variations of supraglottic laryngectomy, partial laryngopharyngectomy, near-total laryngectomy, or total laryngectomy between 1988 and 1992, 16 patients appropriate for inclusion in this study developed postsurgical fistulas. Eight of these patients were treated with traditional medialization procedures, and the other 8 patients were treated with suction drainage. Comparison of the two groups revealed no significant difference with respect to complications or time to fistula closure. The advantages of simplified postsurgical care, less patient discomfort, reduced time demands on the clinician, and cost containment were noted for the group treated with suction drainage.

LARYNGOSCOPE, 105:1337-1341, 1995

## INTRODUCTION

Pharyngocutaneous fistulas are widely described as resulting from a breakdown of the mucosal suture line after head and neck surgery. A number of studies<sup>1-7</sup> have shown that previous radiotherapy or chemotherapy, malnutrition, poor surgical technique, infection, vascular compromise, persistent cancer, and hypothyroidism increase the risk of fistulization. Despite this knowledge and despite optimization of patient health prior to surgery, fistula formation remains quite common, with an incidence ranging from 7.6% to 50%.<sup>2,8-10</sup>

From the Department of Otolaryngology-Head and Neck Surgery, Loyola University Medical Center, Maywood, Ill.

Editor's Note: This Manuscript was accepted for publication June 22, 1995.

Send Reprint Requests to Robert W. Bastian, MD, Loyola University Medical Center, Department of Otolaryngology-Head and Neck Surgery, Building 105, Room 1870, 2160 S First Ave., Maywood, IL 60153.

In the context of traditional thinking about mucosal breakdown, as well as the other factors that contribute to fistulization, the senior author (R. W.B.) noted that large defects in the mucosal lining after laser resection of selected tumors of the pharyngeal walls, pyriform sinus, or base of tongue never resulted in fistula formation (even in patients with numerous risk factors for this complication) unless a skin flap was also elevated. This simple observation led to an examination of the role of the elevated skin flap in fistula formation and then to an alternate concept of skin-flap management using suction drainage alone as a way to decrease the morbidity, inconvenience, and cost of fistula treatment.

The rationale for this alternate method is as follows: When a fistula occurs, saliva and pus accumulate between the skin flap and its bed, eventually draining through the skin incision line. Even with prompt "medialization" (*i.e.*, incision of the neck flap in the midline with Penrose drain insertion to allow short-tract egress of pus and saliva), a potential space under the skin flap similar to a partially drained abscess cavity can form. In other words, if the outflow of pus and saliva from under the skin flap is passive, one might expect that widespread and poorly localized soiling of this space would occur. This residual pus and saliva (resulting in a lingering odor, cellulitis, and an elevated white blood cell count) can persist for several days after traditional medialization.

The senior author reasoned that one suction drain could be placed expectantly at the time of each operation, in effect assuming that every patient would develop a fistula. The same drain would serve as a fistula drain, should that complication ensue. In other words, simply keeping in situ one precisely placed operative drain should work better than traditional medialization, because it should dynamically evacuate fistula fluid from the space between the flap and its underlying bed, thereby keeping subflap contamination more localized.

## MATERIALS AND METHODS

Between January 1988 and April 1992, either the senior author or one of two other attending surgeons performed transcervical surgery on the larynx and pharynx of 133 patients. Operations performed included standard or extended versions of total laryngectomy, near-total laryngectomy, supraglottic laryngectomy, partial pharyngectomy,

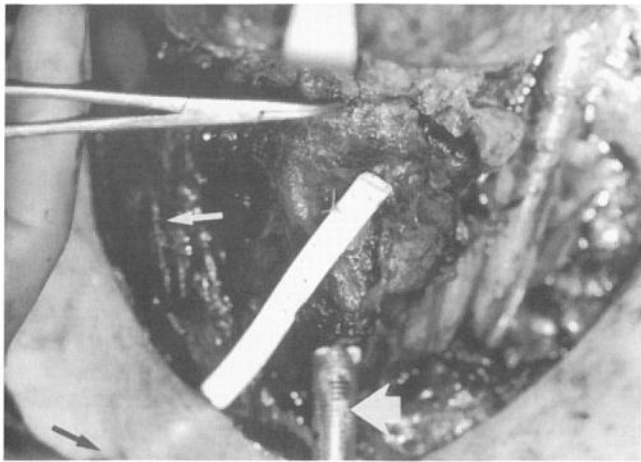


Fig. 1. Intraoperative "safety drain" placement at the conclusion of a supraglottic laryngectomy, left modified radical neck dissection, right functional neck dissection. A hemostat points to the pharyngeal closure line (potential breakdown). The large white arrow identifies the endotracheal tube. Note that a 7-mm suction drain is sutured in position 2 cm from the potential point of breakdown and exits inferolaterally through a separate stab wound (black arrow). The right side of the neck is chosen as the exit point because of the intact sternocleidomastoid muscle (small white arrow), which may offer additional protection to the carotid artery if a fistula develops. Additional drains are used for the neck dissections, but the single drain shown in this figure can serve to control the fistula (if it develops). Other drains are removed when serosanguineous output drops below 20 mL per day.

partial laryngopharyngectomy, and total laryngopharyngectomy. The charts of 118 of the 133 patients were available for review. Fistulas formed in 19 of these patients (19% incidence). Three patients with fistulas are excluded from the study because they were not managed by either medialization or suction drainage exclusively, leaving 16 patients for analysis. Eight of the remaining 16 patients were managed by traditional methods, and the other 8 patients were treated by suction drainage alone.

The diagnosis of fistula formation was based on the presence of several of the following: neck flap edema and erythema, saliva or pus in an incision line or drain tubing, odor, fever, or an elevated white blood cell count.

In the first (traditional) technique, suction drains that had been placed at the time of surgery were removed upon diagnosis of a fistula. The fistula was then medialized by placement of a Penrose drain through a small midline incision in the skin flap. Twice-a-day wound irrigation and pressure dressings were then instituted.

For the second method, procedures were modified somewhat as experience was gained. Ultimately, one "safety drain" (occasionally, two drains) was placed intraoperatively, with its wound end approximately 2 cm from the point of highest risk of breakdown (e.g., superior end of the mucosal suture line for total laryngectomy). The drain was then brought out through a separate stab wound that was usually inferior and several centimeters lateral to the skin incision (Fig. 1). If this drain was noted to contain saliva or pus in the postoperative period, it was kept in place (Figs. 2 and 3). In this manner, pus and saliva were evacuated completely on a moment-to-moment basis, thereby keeping surrounding areas of the skin flap seated to its underlying bed.

Other drains, such as those used in the bed of a neck

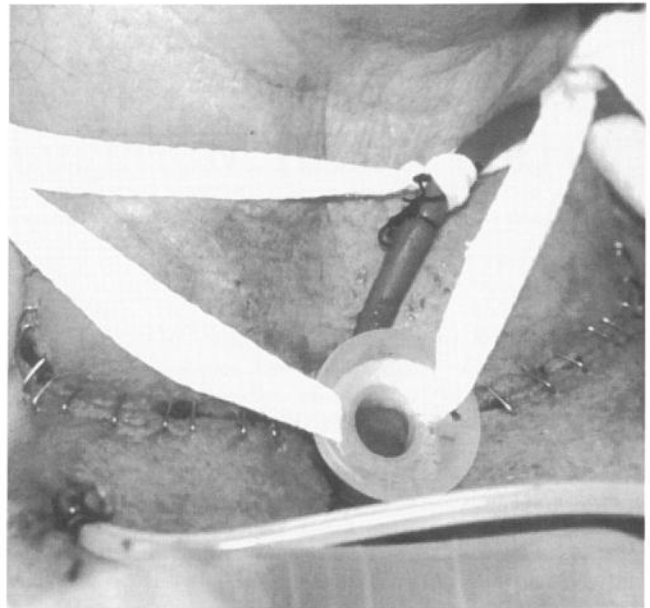


Fig. 2. Single safety drain to control a fistula that developed 7 days after total laryngectomy in a 39-year-old woman who failed full course radiotherapy for subglottic cancer. Methylene blue-colored water that she drank fills the tubing, confirming the existence of a fistula.



Fig. 3. Safety drain used to control a fistula 8 days after a near-total laryngectomy procedure in a 66-year-old man who had previously undergone a full course of radiotherapy. Diffuse flap erythema is present, and the drain tubing contains purulence and saliva. (The medial tubing is a red rubber catheter serving as a stent in the larynx remnant.)

dissection "far away" from the drain containing pus, were removed per clinical routine. The "fistula drain" was kept in place until turbid fluid in the tubing changed back to serum. When this happened, the drain was removed if the tract was short. However, when the tract was long, the drain was re-

TABLE I.  
Preoperative and Perioperative Factors By Management Scheme.

Factors	Medialization	Suction Drainage
Number in group	8 patients	8 patients
Median patient age	58±8 y	57±16 y
Sex	5 men 3 women	5 men 3 women
Stage of disease		
I	1 patient	None
II	1 patient	1 patient
III	1 patient	1 patient
IV	None	3 patients
Prior radiation therapy	5 patients	3 patients
Mean albumin level	3.8±0.8 g/dL	3.7±0.5 g/dL
Mean preoperative hemoglobin level	13±2 g/dL	12±2 g/dL
Mean postoperative hemoglobin level	10±1 g/dL	10±1 g/dL
Hypothyroidism	2 patients	None
Diabetes mellitus	None	None
Mean white blood cell count	9±3×10 <sup>3</sup> /mL	8±2×10 <sup>3</sup> /mL
Clinical neck disease (N+)	2 patients	4 patients
Pectoralis flap	1 patient	1 patient
Neck dissection		
Selective	3 patients	3 patients
Modified*	2 patients	4 patients
Procedures:		
Subtotal supraglottic laryngectomy	1 patient	None
Near-total laryngectomy	None	6 patients
Total laryngectomy	3 patients	1 patient
Total laryngopharyngectomy	1 patient	1 patient
Partial laryngopharyngectomy	2 patients	None
Partial pharyngectomy	1 patient	None

\*Includes sternocleidomastoid muscle resection.

moved, shortened, and then reinserted one or more times before final removal. If appropriate, the distal centimeter of the tract was gently probed with a cotton swab soaked in hydrogen peroxide for an additional day or two following complete removal of the drain in order to avoid abscess formation in the drain tract.

Selection of technique was not randomized. Early on, only the patients of the senior author were managed with suction drains, while those of the two other attending surgeons were managed with traditional procedures. This pattern has changed, and almost all of the recent fistulas were managed by suction drains. Antibiotics (cefazolin [1 g every 8 hrs.] and metronidazole [500 mg every 6 hrs.]) were given perioperatively and postoperatively in both treatment groups, and the duration of therapy depended on physician preference.

To ensure a fair comparison of the two methods of fistula care, the patient groups were compared with respect to type of operation, age, nutritional status, white blood cell count, hemoglobin level, evidence of preoperative radiation therapy, and the presence of diabetes and/or hypothyroidism. The time to fistula closure, the final healing outcome, the time required for fistula care, costs, and patient comfort were then evaluated and compared by method.

#### Case Example 1: Traditional Medialization

A 60-year-old man who had been treated with 50-Gy ex-

ternal-beam irradiation and a boost of neutrons in 1980 for a left tonsil squamous cell carcinoma presented with right-sided otalgia. Examination revealed a T2, N0 squamous cell carcinoma of the right aryepiglottic fold and anterior pyriform wall. Given his severe lung disease and previous radiotherapy, he underwent total laryngectomy on June 3, 1991, without pectoralis muscle prophylaxis.

Drains that had been placed routinely intraoperatively were noted on postoperative day 5 to be passing saliva mixed with turbid fluid. The patient's neck was also erythematous and indurated. Following traditional procedures, suction drains were removed, a Penrose drain was placed through the flap in the midline at the submental crease, and twice-a-day Dakin's solution irrigations and pressure dressings were initiated. After 22 days of labor-intensive wound care, the fistula closed, and the patient was discharged from the hospital.

#### Case Example 2: Suction Drainage

On November 25, 1989, a 55-year-old woman underwent an extended near-total laryngectomy, bilateral neck explorations, and pectoralis myofascial flap reconstruction for a T3, N0 squamous cell carcinoma of the right pharyngeal wall extending to the nasopharynx, the base of the tongue, the epiglottis, and the pyriform sinus.

On postoperative day 6, subtly turbid fluid and saliva were noted in the tubing of the patient's last remaining "safety drain." This suction drain was maintained in position to assess the character of the drainage and to dynamically remove frank pus and saliva from under the flap. No medialization, dressings, or irrigations were used. By postoperative day 20 (see "Discussion"), the tubing again contained only transparent (serous) fluid, which was being produced in just small amounts. The flap edema and erythema had resolved. Therefore, the drain was removed, and the patient was discharged from the hospital.

## RESULTS

As compared with the suction drainage group, the medialization group included slightly more patients with previous radiation therapy and hypothyroidism but fewer with advanced stage cancer, cervical metastasis, or modified neck dissection (Table I). The mean age, albumin level, hemoglobin level, white blood cell count, and history of diabetes were similar in both groups. Magnitude of resection was also comparable for both groups. Of note is that six of the eight patients in the suction drainage group had undergone near-total laryngectomy.

Figure 4 compares the average postoperative day of fistula onset and the average time to closure for the patients treated with medialization and those treated with suction drainage. There is no statistical difference in fistula onset and duration in those fistulas that closed. No serious complications, such as carotid blow or death, occurred in either group. No patient developed an abscess in the fistula tract after drain removal.

Whether considered in terms of dressing supplies or clinician time, suction drainage cost less than the

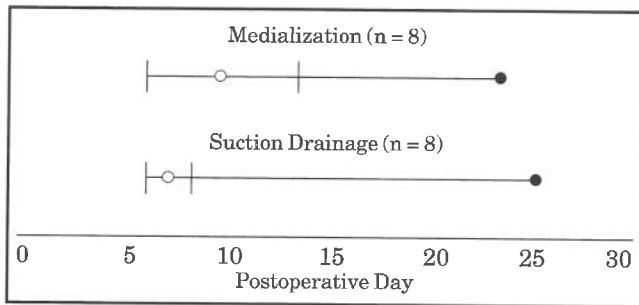


Fig. 4. Average postoperative days of fistula onset (○) and closure (●) in patients managed with either medialization or suction drainage. The fistulas of two of the eight patients managed with medialization never resolved and therefore were excluded from the graph. The fistula of one of the eight patients managed with suction drainage never resolved and therefore was excluded from the graph. The vertical lines represent the standard deviation of the average day of fistula onset.

medialization method for the management of fistulas (Table II).

## DISCUSSION

It should be emphasized that the best "treatment" of fistulas is prevention. Thus, awareness and optimization of patient factors relating to nutrition, previous irradiation, hemoglobin level, hypothyroidism, the presence of infection, and other systemic disorders are, along with careful surgical technique, key considerations in fistula prevention.<sup>16-19</sup>

The importance of prevention notwithstanding, this study focused primarily on the management of fistulas once they had occurred. Much of the literature on fistula management addresses the use of various flaps for closure of persistent fistulas. A smaller body of work mentions primarily traditional medialization and pressure dressing.<sup>11-15, 20</sup> Only a single cryptic comment by Conley<sup>20</sup> is to be found concerning the possibility of suction drain management for small fistulas.<sup>4</sup> To our knowledge, there are no reports that advocate the routine use of suction drains alone in fistula management.

It is notable that six of the eight patients in the group with suction drains had undergone near-total laryngectomy. Patients undergoing this procedure had the highest incidence of fistula formation in this series. We have no definite explanation for this higher rate, although the extent of resection or technical error early in our surgical experience with this procedure may have been contributing factors.

Head and neck surgeons would most likely accept the idea of managing fistulas with suction rather than Penrose drains, if both were placed at the midline in order to divert fistula fluid from the area of the carotid sheath. There would seem to be little argument against active versus passive evacuation of fistula fluid from beneath the skin flap.

On the other hand, directing the drainage tubing

TABLE II.  
Cost of Supplies and Labor By Management Scheme.

	Medialization	Suction Drainage
Supplies	\$20.00 × 16 d = \$320.00*	\$0.00 × 16 d = \$0.00*†
Labor (Time)	10 min × 16 d = 160 min	1 min × 16 d = 16 min

\*Assumes \$20.00 supplies used twice daily for 16 days, which is the average duration of a fistula.

†The cost of the suction drain is omitted, because both groups had the drains placed intraoperatively. In the case of fistula formation, the drain would be replaced by a medially positioned Penrose drain for the medialization group or kept in situ for the suction drainage group.

more laterally, as we have come to do routinely, may initially appear to be a more questionable practice. We began to leave suction drains in their more lateralized position for three basic reasons. First, when the neck is very short, there is very little distance between the level of the potential mucosal leak and the tracheotomy in the midline, making it hard to keep a seal. More importantly, as we gained experience, we noted that with suction-managed fistulas, there was a quick change from a large amount of turbid drainage to a small amount of serous output and that, accordingly, there seemed to be relatively little threat to the skin flap or carotid sheath—all of this made us "trust" a more lateral position for the drains. Third, in one previously irradiated patient in whom the drain was placed through the flap in the midline, the small hole for the drain would not heal, and a small fistula persisted until it was closed surgically. This led to the concept of *desiring* intervening soft tissue between the pharyngeal leak and the laterally placed exit site for the drain.

We maintain that so long as fistula fluid is completely removed as it is formed, the skin flap and deeper neck tissues (probably even the carotid sheath) are able to fend for themselves, even in the case of previous irradiation. At the present time, therefore, a suction drain whose wound end is placed expectantly during surgery near the site of potential failure and whose tubing is brought out for convenience purposes through a separate stab wound inferolaterally serves as a "safety drain" that later can become a fistula drain if this complication occurs.

We have learned to fix the perforated wound end of the drain with a loose loop of suture or to sew it to a filament of tissue that is not directly at the point of potential mucosal suture-line breakdown but is a couple of centimeters inferior or lateral to it. This is because leaving a small amount of soft tissues between a pharyngeal leak and the wound end of the suction drain gives the skin flap a greater potential to "stick down" to its bed between the tip of the drain and the hole in the mucosal suture line; the presence of intervening tissue also lessens the likelihood that the drain will simply suck air.

Before 1988 (the start of this study), we had also learned the importance of "backing out" a very long fis-

tula drain in order to minimize the possibility of abscess formation within a long nonsterile tract. Because the fistula drain had, of course, been sucking grossly contaminated fluid, we did not find any conceptual problem with removing the long drain, shortening it, and then reinserting the same drain into its tract under semisterile conditions at the bedside. The drain-shortening procedure was also used a few days postoperatively when a drain was found to be sucking air continuously.

One important question is whether the use of suction drains may increase the rate of fistula formation. This is highly unlikely. In our series, the overall incidence of fistula development was 16%, which is at the low end of the range of incidence rates reported in the literature. Furthermore, suction drains were placed intraoperatively for all patients but were left in place for those patients who were managed by suction drainage. Finally, a review of our institutional rate of fistula year by year, both before and after suction drain management became routine, shows no significant difference in the incidence of fistula formation.

Depending on the management technique, patient experience and physician labor were notably different. The patients managed with the Penrose drain and dressing technique were quite uncomfortable and complained frequently not only about the discomfort of wearing a dressing but also about the manipulations involved in wound care. By contrast, the patients managed with suction drains were unencumbered by dressings and experienced no discomfort or inconvenience from the fistula, other than the lengthened hospital stay.

Because of this marked difference in management, we have begun to discharge patients from the hospital within days of fistula diagnosis with the fistula drain in situ. Several recent patients who developed fistulas were managed in this fashion as outpatients once their white blood cell count normalized, the "high output" days of the fistula were past, and the fistula was clearly shown to be well controlled as judged by assessment of the skin flap. In retrospect, several of the patients reported in this series (including the one in case report 2) could have been discharged *much earlier* and followed frequently on an outpatient basis. In this manner, the hospital stay could have been far shorter, the psychologic hardship on the patient could have been even less, and costs could have been dramatically reduced.

## CONCLUSION

Fistulas remain a relatively common complication in patients undergoing surgery for cancer of the laryngopharynx. We believe that for fistula management, the use of suction drainage alone is superior to traditional medialization methods. While no signifi-

cant difference could be seen between our two patient groups with respect to safety, long-term outcome, or time to fistula closure, suction drains simplified post-surgical care, lessened patient discomfort, and reduced demands on the clinician. If in the future patients with fistulas are managed at home after initial treatment is completed, suction drainage will dramatically contain costs by decreasing the materials used, reducing physician and nurse labor, and, perhaps most importantly, markedly reducing the length of hospitalizations.

## BIBLIOGRAPHY

1. Bresson, K., Rasmussen, H. and Rasmussen, P.: Pharyngo-Cutaneous Fistulae in Totally Laryngectomised Patients. *J Laryngol Otol*, 83:835-842, 1974.
2. Lavell R.J. and Maw, A.R.: The Aetiology of Post-Laryngectomy Pharyngo-Cutaneous Fistulae *J Larngol Otol*, 86:785-793, 1972.
3. Powers, W.E., Ogura, J.H. and Palmer, L.A.: Radiation Therapy and Wound Healing Delay: Animals and Man. *Radiology*, 89:112-115, 1967.
4. Fredrickson, J.M. and Haight, J.S.J.: Prevention of Pharyngeal Fistulae. In: *Controversy in Otolaryngology*. J.B. Snow (Ed.). W.B. Saunders Company, Philadelphia, pp. 369-392, 1980.
5. Rusca, J.A., Burnside, G.H. and Cohn, I.: Everting Versus Inverting Gastrointestinal Anastomoses: Bacterial Leakage and Anastomotic Disruption. *Ann Surg*, 169:727-735, 1969.
6. Smith, M. and Inquist, I.F.: A Quantitative Study of Impaired Healing Resulting From Infection. *Surg Gynecol Obstet*, 125:965-973, 1967.
7. Dehain, J.J., Freyss, G., Bonhomme, F., et al.: Role du rapport serine-globuline dans les retards de cicatrisation en cancérologie pharyngo-laryngée. *Ann Otolaryngol Chir Cervicofac (Paris)*, 86:576-577, 1969.
8. Horgan, E.C. and Dedo, H.H.: Prevention of Major and Minor Fistulae After Laryngectomy. *LARYNGOSCOPE*, 89:250-260, 1979.
9. Dedo, D.D., Alonso, W.A. and Ogura, J.H.: Incidence, Predisposing Factors and Outcome of Pharyngocutaneous Fistulae Complicating Head and Neck Cancer Surgery. *Ann Otol*, 84:833-840, 1975.
10. Lundgren, J. and Olofsson, J.: Pharyngo-Cutaneous Fistulae Following Total Laryngectomy. *Clin Otolaryngol*, 4:13-23, 1979.
11. Rubin, J.S.: Repair of Post-Laryngectomy Pharyngeal Fistulae. *J Laryngol Otol*, 103:302-305, 1989.
12. Jaffe, B.F.: Oral-Cutaneous Stomas for Oral Cavity Cancer. *Arch Otolaryngol*, 93:275-279, 1971.
13. Myers, E.N.: The Management of Pharyngocutaneous Fistula. *Arch Otolaryngol*, 95:10-17, 1972.
14. Robb, G.L. and Swartz, W.M.: Pharyngocutaneous Fistulas: Management With One-Stage Flap Reconstruction. *Ann Plast Surg*, 16:125-135, 1986.
15. DeVries, E.J., Myers, E.N., et al.: Jejunal Interposition of Repair of Stricture or Fistula After Laryngectomy. *Ann Otol Rhinol Laryngol*, 99:496-498, 1990.
16. Briant, T.D.R.: Spontaneous Pharyngeal Fistula and Wound Infection Following Laryngectomy. *LARYNGOSCOPE*, 85:829-834, 1975.
17. Joseph, D. and Shumrick, D.: Risks of Head and Neck Surgery in Previously Irradiated Patients. *Arch Otolaryngol*, 96:381-384, 1973.
18. Yarrington, C.T., Yonkers, A.J. and Beddoe, G.M.: Avoiding Complications in Radical Neck Dissection. *LARYNGOSCOPE*, 86:325-330, 1976.
19. Talmr, Y.P., Finkelstein, Y. and Zohar, Y.: Pharyngeal Fistulas in Postoperative Hypothyroid Patients. *Ann Otol Rhinol Laryngol*, 98:267-268, 1989.
20. Conley, J.J.: Management of Pharyngostome, Esopharyngostome and Associated Fistulae. *Ann Otol Rhinol Laryngol*, 65:76-91, 1956.