Reconstructive Surgery after Hemilaryngectomy for Recurrent Thyroid Cancer Using a Free Jejunal Patch-Graft

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Case Report

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This case report describes the third recurrence of a poorly differentiated follicular thyroid carcinoma that led to destruction of the thyroid cartilage. Curative surgery required hemilaryngectomy. Because of three previous operations (including neck dissection) and repeated external radiation, the typical laryngoplastic procedures and muscle flaps were not applicable. We therefore employed a stretched jejunal patch to cover the defect so that the neoglottic slit rendered respiration and phonation possible. Thus this approach resulted in functional reconstruction and obviated the need for a tracheostoma. We conclude that the use of a jejunal transplant represents a viable alternative to local reconstruction, particularly in cases complicated by previous surgery and external radiation. (*Plast. Reconstr. Surg.* 93: 860, 1994.)

Local recurrences of thyroid carcinomas represent a serious challenge inasmuch as the recurrences are in intimate contact with surrounding anatomical structures. As in other invasive head and neck tumors, radical surgery may require the concomitant removal of the invaded tissues, in particular, the esophagus, larynx, and trachea. If only the outer wall of these organs is involved, a common procedure involves "shaving" the affected layers,[1,2] thus preserving the structural and functional integrity of the organ. However, if this procedure does not control local progression, partial resection of the affected organs can become necessary. In our patient, we performed hemilaryngectomy because of destructive infiltration of the thyroid cartilage. For reconstruction, local tissue was not available because of damage and loss after previous radical neck dissection, local chemotherapy, and external radiation. Thus a free jejunal patch-graft was used to cover the defect.

Case Report

The patient was a 53-year-old man with a follicular thyroid carcinoma, first diagnosed in 1982.

First Operation

In July 1982, the patient presented with a thyroid nodule that appeared as an autonomous adenoma upon technetium-99 pertechnate scanning. There was no clinical sign of malignancy. Upon surgery, a large tumor (7 × 5 cm) was noted, which extended beyond the thyroid capsule and was close to the tracheal wall. The intraoperative frozen section revealed a follicular thyroid carcinoma with lymph node metastases. Thyroidectomy and neck dissection resulted in a macroscopically radical operation. Follow-up treatment consisted of repeated high-dose radioiodine therapy (^{131}I) and suppression by thyroxine. Four years later, routine follow-up revealed a local recurrence 2-cm in diameter that involved the right thyroid cartilage.

First Local Recurrence—Second Operation

In September 1986, the local recurrence and the adherent muscles were removed. By postoperative histopathological criteria, the resection was microscopically incomplete inasmuch as the tumor extended beyond the laryngeal resection line. In spite of radioiodine treatment, a second local recurrence with invasion of the thyroid cartilage developed within the next year.

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Second Local Recurrence—Third Operation

In January 1988 a partial resection of the right thyroid cartilage was done, wherein the distal part of the cartilage was removed. The laryngeal mucosa was preserved because upon intraoperative histological examination, the resection was judged to be complete. Adjuvant therapy consisted of local application of the synthetic antineoplastic anthracenedione mitoxantrone (Novantrone, 5 mg diluted with 20 ml isotonic saline at the drainage site immediately after wound closure). Three years later, a routine computed tomography scan again detected a 2 × 3 cm tumor, with complete destruction of the right thyroid cartilage and intraluminal extension to the mucosa of the right vocal cord.

Third Local Recurrence—Fourth Operation

In October 1991, a right hemilaryngectomy was performed. The right hemilarynx was extensively (more than 80 percent) resected, the epiglottis was preserved, and reconstruction was done using a free transplanted jejunal patch-graft (Figs. 1 and 2). For this purpose, a roughly 10-cm long jejunal segment was removed and perfused. The microvascular anastomosis was performed as follows: the jejunal artery was connected end-to-end with the facial artery and the jejunal vein end-to-side with the internal jugular vein. Subsequently, the jejunal lumen was opened and a 6 × 3 cm patch was prepared. This patch was used to cover the existing defect such that the width of the glottis would suffice, even if the remaining left vocal cord were held in its median-most position. A protective tracheostoma was not performed. Histological examination revealed a poorly differentiated follicular thyroid carcinoma that was destroying the thyroid cartilage and invading the vocal cord. The resection was complete.

The patient remained intubated for 17 days because of an acute postoperative psychiatric syndrome that required extensive sedation. Extubation was successful and the subsequent postoperative course was uneventful. After 28 days, an endoscopic follow-up examination showed that the jejunal patch was viable and that mucosal healing was almost complete. The width of the glottic slit was 0.5 cm, and the mobility of the left vocal cord was well preserved. Respiration and deglutition were close to normal. At the last check-up (January 1993), the patient exhibited no recurrence. Phonation is essentially unimpaired such that communication is possible over the telephone. Respiration and deglutition are unaltered.

DISCUSSION

In contrast to squamous cell carcinomas of the head and neck, patients with differentiated thyroid carcinoma have a comparably good survival rate. Hence, the decision to extend surgery to affected organs such as the trachea, esophagus, and larynx, with the possible need of a tracheostoma, is not reached easily. A review of the literature shows that a conservative approach is generally preferred and that shaving the outer layers[1,2] is the generally performed procedure. There are only a few studies available that report on series of patients with extended surgery[3–8]; in particular, resections of the cartilageneous laryngeal skeleton are rarely carried out.

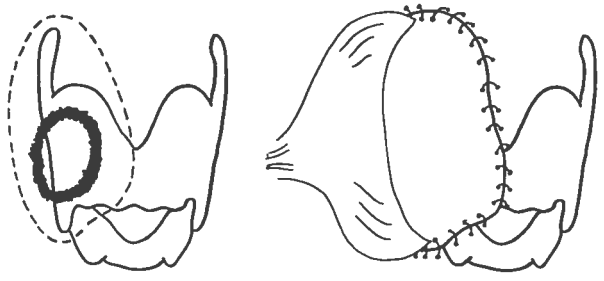

FIG. 1. Schematic drawing of the tumor and the resection line (*left*), and the reconstructed larynx (*right*).

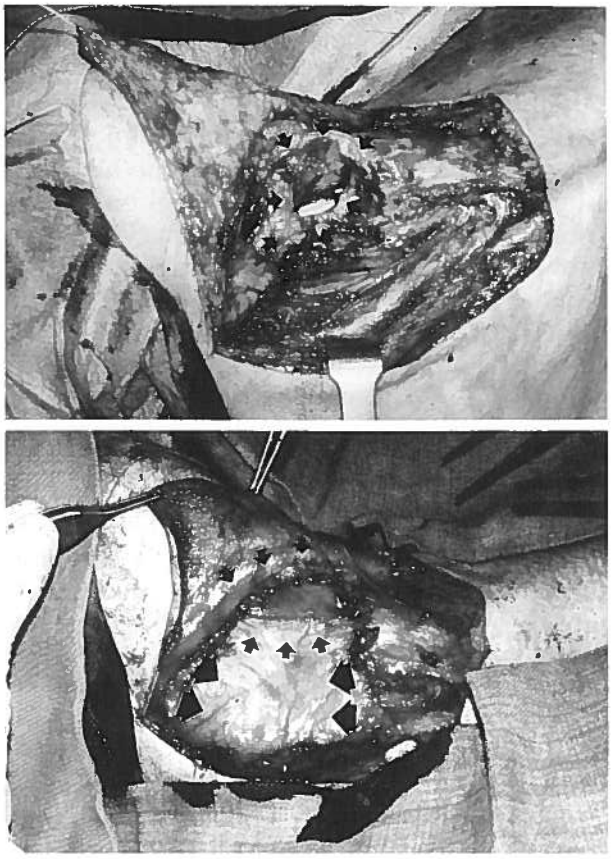

FIG. 2. (*Above*) Intraoperative view of the laryngeal defect (marked by *arrows*) after subtotal hemilaryngectomy. (*Below*) Intraoperative view of the reconstruction. *Arrows* mark the jejunal patch graft, *arrowheads* point to the mesenterium.

The history of our patient illustrates the dilemma; shaving the laryngeal skeleton achieved local control of the disease only temporarily, and recurrence was not prevented. Because the cancer had infiltrated the vocal cord, complete surgery required hemilaryngectomy. In the preoperative planning of the functional reconstruction, the following limiting factors had to be considered: our patient's several previous operations, including neck dis-

section (thus limiting the available muscles), external radiation, and local chemotherapy. In general, the following goals have to be met in an attempted functional reconstruction of the larynx: (1) Respiration must be maintained in the absence of a tracheostoma; i.e., the neoglottic slit must be wide enough. (2) Deglutition must remain unimpaired and the danger of aspiration minimized. (3) Phonation must be adequate for daily communication; i.e., the neoglottic slit must be narrow enough.

Several approaches for reconstructive surgery of the larynx are available; epiglottic laryngoplasty is a common technique well suited for reconstructing the vocal cords, but it is inadequate for oncological patients (such as ours) with large defects.[9] In addition, laryngoplasty in our patient was limited by the radiation-induced tissue damage. This limitation also applies to various approaches that use local muscle flaps, such as the prelaryngeal[10,11] or the sternomastoid muscle,[12,13] to cover the defect. Furthermore, these muscles would either have been removed in the previous neck dissection or their blood supply damaged. Hence, only pedicled flaps (pectoralis major, trapezius) could be used.[14] Free transplanted skin flaps represent additional alternatives.[15] These flaps, however, have the drawback of preventing the respiratory epithelium from lining the endolaryngeal surface of the flap. Similarly, the regeneration of cutaneous appendages may be unfavorable. Nevertheless, free transplanted flaps offer the advantage of an autochthonous blood supply and no radiation-induced damage. The free jejunal transplant has these advantages without the above described drawbacks; in addition, the supply of jejunum is unlimited and the jejunal patch can easily be adapted to cover almost any defect. Therefore, jejunal grafts are generally well suited for reconstruction in head and neck surgery.[16] Although they have been extensively used in the reconstruction of the cervical esophagus and hypopharynx, to our knowledge, jejunal grafts have not been employed for covering laryngeal defects. One of the major problems in this respect is the stability of the patch in the ventilation-induced pressure cycles. In our patient, the stretched patch was grafted on to the right hemilarynx such that the width of the glottis was sufficient for breathing. The intubation period of 17 days, which was required because of the extensive sedation of the patient, might have contributed to the healing and stabilization of the graft. In this case, it is certainly a matter of debate as to whether protective tracheostomy was required. For safety reasons, we usually do recommend a cannula in order to avoid a critical situation resulting from postoperative airway obstruction. To our eyes, the optimal placement of the jejunal patch, combined with the prolonged postoperative intubation period, provided adequate stabilization of the graft. This was the first prerequisite to justify omission of a tracheostoma.

We also had to consider the problem of aspiration caused either by a bolus or by the mucosal secretion of the intestinal patch-graft. Our experience with a series of 107 free intestinal autografts for reconstruction of the upper aerodigestive tract[17] revealed that peristaltic function and mucosal secretion of free transplants is reduced with prolonged ischemia time; the functional integrity of the transplant—which is required for reconstruction of the cervical esophagus—is maintained if the microvascular anastomosis is rapidly established. In contrast, ischemia times of up to 5 hours are tolerated by the graft tissue, but the function of the epithelium is progressively impaired. The enteric mucosa desquamates and is replaced by a neomucosa, which has a reduced secretory capability; the micromorphological changes in transplanted jejunum include atrophy of the mucosa and jejunal glands, with a reduced absolute number of goblet cells.[18,19] In our patient, ischemia time was long, i.e., 110 minutes. Healing of the neomucosa was almost complete 4 weeks after surgery, as assessed by laryngoscopy, and there was no major mucosal secretion from the transplanted patch. The patient rapidly learned to swallow, and major aspiration never occurred. Eighteen months after surgery, the patient was not restricted in his social activities; respiration and deglutition were unimpaired; and phonation was adequate enough for telephone conversation.

We believe that jejunal grafts can be used to bridge substantially larger laryngeal defects without protective cannula, if the jejunal patch is stabilized by cartilage or ceramic supports. Recently, we have successfully used ceramic supports for the stabilization of a jejunal transplant in a complete replacement of the larynx. Similarly, silastic miniplates have been used to stabilize the laryngeal skeleton.[20] In an experimental study on tracheal reconstruction, the

jejunal loop was stabilized by a sylastic T-tube placed inside.[21]

The advantages with respect to the functional reconstruction summarized above have to be weighed against potential complications arising from the microvascular technique of free transplantation itself, and from the need of a second, intraperitoneal operation field. However, of 107 consecutive free jejunal grafts,[17] intraabdominal complications occurred in only a single patient, in whom bleeding from a mesenteric vessel was detected immediately and was controlled within the same operation. In this series, pharyngolaryngectomy was carried out for advanced laryngeal, hypopharyngeal, and esophageal cancer. Thus, the autograft was used for pharyngo-esophageal reconstruction and/or for voice restoration as a tracheopharyngeal shunt. Necrosis of the free transplanted jejunum developed in nine patients (8.5 percent), two of whom underwent successful retransplantation, and one had colonic interposition. In one patient reconstruction was achieved by a pectoralis muscle flap and in three cases with a tracheopharyngeal shunt, the graft was simply removed. Two patients died from acute arrosion bleeding without undergoing reintervention.

The surgical procedure described in this case report is demanding, both with respect to planning and coordinated teamwork. Cooperation between general surgeons and plastic surgeons experienced in microvascular technique is mandatory for obtaining optimal results.

SUMMARY

In local recurrences of thyroid carcinomas with extensive invasion, preservation of a functional larynx might not be achievable. We therefore propose that complete removal of the affected laryngeal tissue should be attempted at the earliest possible time. The aim is to not miss the opportunity for curative surgery and to spare the patient's undergoing a permanent tracheostoma. This radical approach should be superior in attaining local control and thus preventing subsequent generalization. We conclude that the reconstruction of the larynx with a jejunal patch is an excellent alternative, particularly for patients with multiple previous operations and external radiation. Furthermore, with this approach a tracheostoma can be avoided, which is most important consideration in functional laryngeal surgery and an invaluable gain for the patient.

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