Salvage Resection After Previous Laryngeal Surgery

Total Laryngectomy With En Bloc Resection of the Overlying Cervical Skin

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Objective: To evaluate the effectiveness of extended total laryngectomy for the treatment of recurrences of laryngeal cancer.

Design: We conducted a retrospective clinical study of patients who had undergone extended total laryngectomy and were seen over a 15-year period. The follow-up period ranged from 3 to 15 years.

Setting: Academic tertiary referral medical center.

Patients: We observed 15 patients who were affected by a recurrence of laryngeal cancer that extended to the overlying soft tissue. All patients were male. The mean age was 61.5 years. Thirteen patients had previously undergone partial laryngectomy, and 2 patients had undergone radiation therapy, without success.

Intervention: All patients underwent total laryngectomy extending to the soft tissue, including the overlying skin.

Results: Five of the 15 patients died of local recurrence, and 1 patient died of massive postoperative hemorrhaging. An actuarial survival rate of 60% was observed at 5 years.

Conclusion: Total laryngectomy extending to the soft tissues seems to be an effective procedure for treating local recurrences of laryngeal cancer after partial laryngectomy or failure of radiation therapy.


Although partial laryngectomies1,2 and the combination of chemotherapy and radiation therapy3 have considerably reduced the number of total laryngectomies that have been performed in the past 40 years, this procedure still remains the most appropriate for specific conditions. A review of the literature reveals significant differences in the treatment of T1, T2, and T3 laryngeal tumors,4-9 whereas T4 laryngeal tumors are usually treated with total laryngectomy.10,11

Although the thyroid cartilage and the perichondrium represent a natural obstacle against the spreading of the tumor outside the larynx, laryngeal tumors that grow toward the front of the larynx sometimes cross the cartilage, thus infiltrating prelaryngeal soft tissues.12-15 In such cases, radiation therapy has not proved to be effective16 owing to the spreading of the tumor to the cartilage. When total laryngectomy is performed, however, the procedure should be extended to the strap muscles or even to the overlying skin.17

This type of surgery, ie, the removal of the larynx in addition to prelaryngeal soft tissues, including the skin, is known as laringectomie carré in France18 and as square total laryngectomy in the rest of Europe17 because it is characterized by the removal of a square skin area overlying the larynx and strap muscles. In US literature,19,20 however, this procedure is not categorized separately but is classified as enlarged or extended total laryngectomy (ETL) or as wide-field total laryngectomy. These case studies include tumors that spread in various directions, either to the front (as in our study) or to the back, toward the hypopharynx and cervical esophagus. Few series of cases treated exclusively with this type of surgery have been previously reported.17

In addition to cases in which the tumor has spread in a forward direction across the cartilage, total laryngectomy is the most suitable approach when the cartilage no longer represents a natural barrier against neoplastic infiltrations, eg, in cases of recurrence in patients who have previously undergone partial laryngectomies.17 Also, in such cases, the recurrence of laryngeal
PATIENTS AND METHODS

From 1981 to 1996, we performed more than 500 partial, total, and subtotal surgical procedures for laryngeal cancer at the Otorhinolaryngology Clinic, "La Sapienza" University–Rome, Rome, Italy.1-6 Out of this series, 15 patients underwent ETL. All patients were male, and their ages ranged from 45 to 77 years (average age, 61.5 years). All patients underwent ETL as salvage surgery because of recurrences of squamous cell carcinoma after partial or subtotal laryngectomies or after failure of radiation therapy (Table). Follow-up lasted from 3 years to 15 years 4 months.

After careful presurgical examination of the tumor extension using endoscopic techniques and imaging, the skin area that is to be removed and that will represent surgical access during the laryngectomy as well as during the neck dissection, when necessary, is outlined. Immediately after the incision of the skin that is to be removed, frozen sections are obtained to determine whether the skin resection margins have been infiltrated. In fact, a subcutaneous neo-plastic lymphangitis may be one of the complications involved in tumors that extend to the soft tissues of the neck.

The incision is continued at full thickness without detachment of the underlying cutaneous, subcutaneous, and muscle layers. The upper resection boundaries may include the hyoid bone and the preepiglottic space, whereas the lower margins may include, when necessary, the entire thyroid gland and 2 or more tracheal rings, depending on the subglottic extension of the tumor. Laterally, the dissection is similar to that of a normal total laryngectomy, with the possibility of a level II to IV neck dissection without any additional skin incisions.

Tissue defects of the hypopharynx due to ETL is closed as in a normal total laryngectomy, whereas the remaining integument defect of the neck requires reconstructive surgery. A pectoralis major myocutaneous flap is used to fill the cutaneous, subcutaneous, and muscle defects. The low margin of the myocutaneous flap is sutured to the first remaining integument defect of the neck re-constructed, whereas the remaining integument defect of the neck is closed as in a normal total laryngectomy, whereas the remaining integument defect of the neck requires reconstructive surgery. A pectoralis major myocutaneous flap is used to fill the cutaneous, subcutaneous, and muscle defects. The low margin of the myocutaneous flap is sutured to the first remaining integument defect of the neck to obtain ample margins of normal skin, whereas diffuse infiltration was found in the thyroid gland in 3 patients who died of recurrence after cricothyroidopexy. All patients underwent radiation therapy after surgery, with the exception of 2 patients who had previously undergone a full cycle of radiation therapy as initial treatment.

RESULTS

Of the 15 patients who were included in this study, 6 (40%) have died (Figure): 5 (33%) had local laryngeal tumor recurrence, and 1 (7%) died of massive hemorrhaging after surgery. Nine patients (60%) are alive with no evidence of disease. Of the 6 patients who died, 1 had undergone a frontolateral laryngectomy, 3 had undergone a supracricoid laryngectomy with cricothyroidopexy, and 2 had undergone radiation therapy, without success.

None of the patients had a recurrence in the lymph nodes, including those who underwent a neck dissection at the time of salvage surgery (Table). In all patients who had undergone external surgery and in 1 who had been treated with radiation therapy, a total thyroidectomy was combined with the laryngectomy.

During surgery, the histological examination of the entire perimeter of the removed skin allowed us to obtain ample margins of normal skin, whereas diffuse infiltration was found in the thyroid gland in 3 patients who died of recurrence after cricothyroidopexy. All patients underwent radiation therapy after surgery, with the exception of 2 patients who had previously undergone a full cycle of radiation therapy as initial treatment.

COMMENT

Treatment of T4 laryngeal carcinoma with extensive cartilage infiltration has always been considered a difficult problem. In fact, it is well known14-16 that the perichondrium and the cartilage itself represent an important natural barrier against tumor spreading toward the outside of the larynx. Because of this characteristic, the larynx can be considered a closed box whose removal helps increase survival rates when compared with many other human tumors. However, according to the literature,21,22 these survival rates decrease to 65% at 5 years after surgery when there is infiltration of the thyroid cartilage without penetration of the soft tissues and to 32% at 5 years in cases of clear penetration and subsequent invasion of the soft tissues of the neck.

However, in cases in which infiltration extends to the skin, the survival rates decrease to 12% to 15% at 5 years after surgery.23 It should be stressed that although radiation therapy is not effective in treating T4 laryngeal tumors with evident infiltration of the thyroid cartilage, it plays a significant role as a complementary treatment. In fact, local tumor control percentages increase by 15% when surgery is combined with radiation therapy, compared with surgery alone.21

Treatment of recurrences of laryngeal carcinoma in patients who have previously undergone external surgery is even more difficult. Surgical interruption of the cartilage during partial or subtotal laryngectomies creates a preferential pathological pathway, allowing the tumor to spread to the soft tissues of the neck. In such cases, the concept of removing the “box” along with the tumor is no longer feasible with a total laryngectomy alone. To reconstruct the concept of a box that can be removed along with the tumor, it is necessary to outline new anatomical boundaries whereby the removal of wide margins of normal tissue compensates for the defensive role that is naturally played even by thin tissues, such as the perichondrium. The problem remains as to how to establish anatomical boundaries that would be capable of containing tumor progression in a forward and outward direction in relation to the larynx.

Strap muscles, when not removed during previous surgery, adhere to thyroid cartilage alae and thus repre-
sent an obstacle against lateral diffusion of the neoplasm and is strongly aided in this by the lateral thyroid gland lobes. The thyroid gland, in fact, can be invaded by an extralaryngeal diffusion tumor as well as by a paraglottic space tumor across the cricothyroid membrane. Therefore, complete removal of the thyroid gland guarantees a resection margin extension for a tumor that is spreading beyond the larynx both laterally (lateral lobes) and downward (thyroid isthmus). The upper boundary of this extended laryngeal box is represented by the hyoid bone, the preepiglottic space, and the elastic laminae that circumscribe it.

Toward the front, however, the en bloc box removal of the larynx, including the strap muscles, the subcutaneous tissue, and a wide area of skin above the tumor, ensures the highest level of tumor control possible. In fact, the attempt to search for a subcutaneous cleavage plane, to maintain the skin’s integrity, may result in loss of tumor control. In our opinion, the only way to stop the neoplastic progression of a tumor growing beyond the natural laryngeal borders is to re-create an “extended” box that can be removed with all its neoplastic contents.

Although some authors claim that removal of the thyroid gland in patients with locally advanced laryngeal tumors does not greatly increase survival rates, we believe that partial or total thyroidectomies are absolutely necessary in cases involving tumors with evident extralaryngeal diffusion. Also, removal of prelaryngeal skin, which represents a safety margin in tumors spreading to the soft tissues of the neck, should not be considered an overtreatment. In fact, an underestimation of subcutaneous tumor infiltration can have disastrous effects, whereas the covering of even a large area of skin removed at surgery can be easily carried out with several reconstructive techniques.

Among the numerous pedunculate and free flaps currently available for reconstruction, the pectoralis major myocutaneous flap still represents, in our opinion, the best alternative owing to its reliability, its speedy execution, and, above all, its thickness, which is suitable for covering the cutaneous, subcutaneous, and muscle defects caused by the surgery.

**CONCLUSIONS**

Treatment of laryngeal tumors with extensive cartilage invasion, as well as of neoplastic laryngeal recurrences spreading beyond the larynx, remains a problem that is yet to be solved. The ETL with en bloc resection of the

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**Actuarial survival rates at 5 years.**
overlying cervical skin, which yields a 60% survival rate at 5 years after surgery, represents a valid therapeutic possibility. Although imaging can provide evidence of soft tissue involvement, we advocate routine sacrificing of the skin in all patients (who have undergone previous laryngeal surgery) who have a recurrence of tumor spreading toward the front of the larynx.

Owing to the limited number of cases in this study, no definitive conclusion can be made regarding whether sacrificing of the skin is always necessary and whether the pectoralis major flap (a standard approach to this problem) is the best reconstructive option. On the other hand, our surgical experience does provide specific data on salvage surgery after modern, more extensive, partial laryngeal resections, thus contributing to the limited knowledge available on this topic.

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