In the past, the selection of treatment for laryngeal cancer was not complicated. Patients with true vocal cord cancer underwent radiation therapy or the laryngofissure and cordectomy procedure. Patients with other "intrinsic" lesions were treated by total laryngectomy; those with "extrinsic" tumors were managed by total laryngectomy and radical neck dissection. Today, however, the introduction of more sophisticated diagnostic and therapeutic techniques has made the choice of treatment more complex.

Treatment should result in maximum cure rates and preservation of maximum uninvolved laryngeal tissue, while producing minimal disability. Thus, conservative procedures are used whenever possible to avoid the severe depression, withdrawal and inability to communicate that may accompany more radical surgery. The choice of conservative therapy is further supported by the finding that only 50 percent of totally laryngectomized patients over 60 years of age develop a serviceable voice. Furthermore, in selected patients, cure rates were not improved when conservative rather than radical surgery was employed.

All surgical modalities discussed in this article are associated with a temporary tracheostomy (except for total laryngectomy) and/or nasogastric or esophagostomy tubes for feeding. The latter are removed when the patient has overcome difficulty in swallowing and aspirating. Rarely, a patient's inability to swallow without aspirating necessitates converting a subtotal to a total laryngectomy.

### GLOTTIC CANCER

More than 95 percent of patients have epidermoid cancer. Cure rates for various treatment approaches are summarized in Table 1. (See pages 204-205.)

**Premalignant, Early T1A Lesions**

The diagnosis and microexcision of a premalignant and "grain-of-rice-sized" T1A lesion have been revolutionized by the development of the operating microscope combined with suspension laryngoscopy. In most instances, a normal voice can be preserved. An 87.7 percent cure rate has been reported for selected patients with small malignant tumors. Radiation therapy is reserved for small cancers and TIS lesions that recur. According to Strong, CO₂ laser therapy may prove valuable for early cancer.
Laryngofissure and Cordectomy

Divide the thyroid cartilage vertically in the midline and retract the edges so that the interior of the larynx may be examined. Remove the tumor with one true vocal cord from the anterior commissure to the vocal process, including the ventricle, lower margin of the false cord, a few millimeters of the subglottic region and the internal perichondrium of the thyroid cartilage.

Miller believes that cryosurgery also shows promise.4

T1A Lesions
For a larger T1A tumor, exceptionally good results may be obtained by laryngofissure and cordectomy, frontolateral vertical partial laryngectomy, or by radiation therapy. The surgical approach is practical for patients who do not have the time and economic resources for treatment by radiation therapy, or those who have a poor understanding of their disease and are not expected to complete therapy. In addition, surgery permits superior evaluation of the extent of the laryngeal disease; if necessary, the operation may be converted to a more radical procedure. However, while the postoperative voice is serviceable, its quality is unpredictable and inferior to that following radiation therapy.

The laryngofissure and cordectomy procedure (Fig. 1.) can remove a small lesion that involves the middle third of a mobile true cord. Cure rates vary between 84 and 97 percent.5-8

Frontolateral surgery (Fig. 2.) is acceptable treatment for a more extensive T1A lesion that may extend posteriorly to the vocal process of the arytenoid cartilage and anteriorly to the anterior commissure. The mobility of the cord should be normal. Cure rates from 74 to 92 percent have been reported.5-10

However, radiation therapy is the preferred method of treatment for most patients, since it preserves an excellent voice. Cure rates range from 80 to 92 percent,6,8,11-14 with a 66 percent surgical salvage.11

T1B Lesions
The frontolateral procedure is used to
excise a lesion that involves one cord, the anterior commissure and/or the anterior end of the opposite cord. Sessions reported a cure rate of 74 percent using this technique, and 61 percent with radiation.\textsuperscript{15}

Following total laryngectomy for patients with more advanced T1A and T1B tumors, the cure rate is 62 percent.\textsuperscript{15}

**T2 Lesions**

Surgical excision has primarily been employed to excise those lesions that infiltrate the submucosa. Extended frontolateral vertical partial laryngectomy (Fig. 3.) is recommended when radiation therapy has failed or when a tumor involves: (1) the true vocal cord, vocal process or anterior surface of the arytenoid cartilage and/or the anterior third of the opposite true cord; (2) a true vocal cord with less than 10 mm. subglottic extension; (3) the floor of the ventricle, vocalis muscle, lower half of the false cord with or without limitation of cord mobility. Techniques have been described by Hautant,\textsuperscript{17} Gros,\textsuperscript{1} Quinn,\textsuperscript{18} Som,\textsuperscript{19} Sisson,\textsuperscript{20} Ogura\textsuperscript{9} and Bailey\textsuperscript{21} with cure rates from 69 to 87 percent.\textsuperscript{7,8,10,22,23} Good results are also shown after radiation, especially when the vocal cord is mobile.\textsuperscript{13}

Anterior frontal vertical partial laryngectomy (Fig. 4.) can remove a horseshoe lesion in the anterior third or half of each true cord and the anterior commissure. It may extend subglottically for less than 10 mm. According to Kirchner and Som, the cure rate is 68.9 percent,\textsuperscript{18} compared to 81 percent for radiation, with an 83 percent surgical salvage.
Table 1. Percent Cure Rates for Glottic Cancer by Treatment and Stage of Disease

| Stage of Disease | Laryngofissure-Condectomy | Frontolateral Vertical Partial Laryngectomy | Anterior Frontal Vertical Partial Laryngectomy | Extended Frontolateral Vertical Partial Laryngectomy |
|------------------|---------------------------|---------------------------------------------|-----------------------------------------------|--------------------------------------------------|
| T1A              | 84 (Hendrickson)⁶         | 75 (Skolnik)⁸                               | 87 (Ogura et al)⁹                             | 92 (Ogura & Biller)⁹                             |
|                  | 89 (Daly & Kwok)⁵        |                                             |                                               |                                                  |
|                  | 90 (Skolnik)⁸            |                                             |                                               |                                                  |
|                  | 97 (Leroux-Robert)⁷     |                                             |                                               |                                                  |
| T1B              |                          | 74 (Sessions)¹⁵                            |                                               |                                                  |
| T2               |                          | 68.9 (Kirchner & Som)¹⁶                    | 89 (Biller)²²                                 | 72 (Skolnik)⁸                                   |
|                  |                          |                                             | 72 (Som)¹⁹                                   |                                                  |
|                  |                          |                                             | 82 (Ogura et al)ⁱ⁰                           |                                                  |
|                  |                          |                                             | 87 (Leroux-Robert)⁷                           |                                                  |
| T3               |                          |                                              | 40 (Skolnik)⁸                                 |                                                  |
|                  |                          |                                              | 56 (Leroux-Robert)⁷                           |                                                  |
|                  |                          |                                              | 94 (Ogura et al)ⁱ⁰                           |                                                  |
| T4               |                          |                                              | 40 (Skolnik)⁸                                 |                                                  |

Total laryngectomy can cure from 69 to 72 percent of patients with more extensive disease.¹⁰.¹⁴ When nodes are positive, a therapeutic neck dissection is advised with removal of the primary. The incidence of lymph node metastases is between 6.6 and 16.7 percent.⁸.²⁴

**T3 Lesions**

The extended frontolateral procedure may also be used to remove a lesion that has produced fixation of the vocal cord due to invasion of the thyroarytenoid muscle and the internal perichondrium of the thyroid cartilage.²⁵ Cure rates of 40 to 94 percent have been reported.⁷.⁸.¹⁰ Total laryngectomy results in cure rates of 45 to 69 percent in patients with cartilage and joint involvement or with supraglottic and subglottic extension of tumor.⁸.¹⁰ Combined therapy cures between 34 and 62 percent of patients.¹².²⁶ In one series, total laryngectomy and a therapeutic radical neck dissection resulted in a 50 percent cure rate; the incidence of lymph node metastases was 25.4 percent for T3 lesions.⁸

**T4 Lesions**

These tumors not only invade the laryngeal cartilages, but extend beyond the larynx and frequently obstruct the airway. The incidence of lymph node metastases is from 18 to 65 percent.⁸.²⁷ Thus, limited procedures are rarely employed. Endoscopic removal of an obstructing tumor, followed by preoperative radiation, total laryngectomy and an elective or therapeutic neck dissection reduce the risk of tracheal stoma recurrence. Combinations of treatment including the modalities listed above, plus postoperative radiation have resulted in cure rates ranging from 0 to 100 percent, depending on the selectivity and number of patients studied.⁸.⁶.¹⁵.²⁷
Supraglottic epidermoid carcinoma is an aggressive disease. It may remain localized above the laryngeal ventricles for long periods of time, and then extend via dehiscences in the epiglottic cartilage to involve the pre-epiglottic space. The most important factor in determining prognosis is the probability of lymph node metastases, reported to be as high as 60 percent and as low as 13 percent. In a marginal tumor, it is the size of the primary that determines prognosis. Cure rates for various treatment modalities are shown in Table 2. (See pages 208-209.)

The concept of subtotal supraglottic laryngectomy (Fig. 5.) developed by Alonso and modified and popularized by Ogura and Som, is based on the fact that supraglottic cancer remains localized above the ventricles and commonly does not invade the thyroid cartilage until late in the course of the disease. This procedure is indicated for lesions at least five mm. above the anterior cornissure. The voice, airway and swallowing mechanisms are preserved.

**T1, T1A and T1B Lesions**

The results of various treatment modalities (Table 2.) suggest that T1 lesions may be controlled by radiation or surgery. The author believes a treatment regimen including surgery is perhaps superior. It is interesting to note that cure rates following supraglottic laryngectomy are equal to those of total laryngectomy. Particular attention must be paid to the management of cervical node metastases; Ogura and Biller reported a 61 percent cure rate in patients with positive homolateral nodes, compared to 85 percent for patients with negative nodes. Preoperative radiation therapy significantly improved the cure rates.
INCISION
THYROID CARTILAGE
VOCAL PROCESS
ARYTENOID CARTILAGE
CRICO-THYROID MEMBRANE
FALSE VOCAL CORD
VENTRICLE
TRUE VOCAL CORD TUMOR
CRICOID CARTILAGE
SUBGLOTTIC REGION
ANTERIOR COMMISSURE

Extended Frontolateral Vertical Partial Laryngectomy

Fig. 3. Divide the thyroid cartilage with two parallel vertical incisions. On the less involved side, make the incision one cm. from the midline and on the more involved side, anterior to the superior and inferior cornu. The segment of thyroid cartilage behind the latter incision supports the pyriform sinus. Open the larynx through the initial incision on the less involved side. On the involved side, remove the adjacent cricothyroid membrane, most of the involved hemithyroid cartilage with the internal and external perichondrium, 10 mm. of the subglottic region, true vocal cord, ventricle, false cord and arytenoid cartilage and, if necessary, a superior margin or complete segment of the cricoid cartilage.

T2 Lesions
In this group, surgical excision of primary and metastatic disease produces superior results. Bocca uses supraglottic laryngectomy and bilateral staged neck dissection, with a 79 percent cure rate. He emphasizes excision of the pre-epiglottic space and hyoid bone perios- teum, with preservation of the hyoid bone.

T3 Lesions
When the tumor is fixed within the larynx, the cure rate after any form of treatment is poor. Supraglottic laryngectomy should only be employed in selected patients. Most require preoperative radiation, followed by total laryngectomy. Elective and/or therapeutic neck dissection should be considered in selected patients.

T4 Lesions
As the tumor extends beyond the larynx and the probability of lymph node metastases increases, the combined use of radiation and surgery is the procedure of choice. In Wang’s series, 70 percent of the patients with negative nodes were cured, compared to 43 percent of those with positive nodes. Many patients with less extensive disease treated by radiation may be salvaged by surgery. The therapeutic regimen described by Taskinen has merit. He studied 932 patients with supraglottic cancers, with an overall cure rate of 36.1 percent; 106
Fig. 4. Make two parallel vertical incisions through the thyroid cartilage on either side of the midline. Elevate the true and false cords and the internal perichondrium behind each incision. Divide both vocal cords anterior to each vocal process. Remove the anterior two-thirds of the cords and the anterior thyroid cartilage. Place a metal or silastic keel in the larynx for six weeks.

patients with early tumors were treated by radiation, with a 58 percent cure rate and 53 patients with advanced lesions underwent combined therapy, producing a 39 percent cure rate. It is the consensus that early cancers (T1 and T2) should be managed by a split-course of radiation therapy. After half the total dose is administered, therapy is discontinued for three weeks. At that time, the decision is made to continue radiation alone or to operate. Surgery may also be employed as a salvage procedure, if the tumor recurs following full-course radiation therapy.

**SUBGLOTTIC CANCER**

Subglottic cancer is very rare. Sessions found only five cases in 591 glottic and subglottic lesions⁴⁰ and Ogura reviewed 13 cases in a 1955 article.⁴¹

The primary subglottic tumor is usually an undifferentiated carcinoma. It ulcerates, fungates, produces airway obstruction and travels via the cricothyroid membrane to involve the soft tissue of the neck, as well as the prelaryngeal, pretracheal and paratracheal nodes that drain to the superior mediastinum and deep cervical region. Norris reported a 16 percent incidence of lymph node metastases.⁴²

This cancer may occur as a primary or secondary disease. A primary subglottic tumor requires total laryngectomy, elective or therapeutic neck dissection, excision of an additional tracheal segment and, sometimes, total thyroidectomy and excision of the nodes anterior and lateral to the larynx and trachea. In selected patients, a superior me-
diastinal dissection should be considered, as well as preoperative radiation therapy. Emergency tracheostomy should be avoided, if possible, to reduce the risk of stoma recurrence. Endoscopic removal of obstructing endolaryngeal tumor is a superior substitute for an emergency tracheostomy. Norris has shown a 66 percent cure rate following total laryngectomy without elective radical neck dissection, versus a 73 percent cure rate when an elective radical neck dissection was performed.\textsuperscript{42} According to Sessions only one patient in five is cured.\textsuperscript{39}

A secondary subglottic tumor originates on the true vocal cords and extends inferiorly into the subglottic region. It is less aggressive and not as well differentiated as the primary tumor. Sessions treated 63 patients by vertical partial laryngectomy and total laryngectomy, with a total cure rate of 73 percent.\textsuperscript{39} In most instances, treatment failure was caused by the development of residual disease at the primary site (31 percent).

**TRANSGLOTTIC CANCER**

Ogura et al.\textsuperscript{24} reported a 57 percent cure rate in 19 patients treated with preoperative radiation therapy, total laryngectomy and radical neck dissection, and a 59 percent cure rate in patients not treated with preoperative therapy. The cure rate in 56 patients was 67 percent, treated by total laryngectomy and radical neck dissection. In those patients with lymph node metastases, the cure rate was 47 percent, and in those patients without lymph node metastases, 76 per-

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Table 2. Percent Cure Rates for Supraglottic Cancer by Treatment and Stage of Disease

| Stage of Disease | Total Laryngectomy | Total Laryngectomy & Radical Neck Dissection | Subtotal Supraglottic Laryngectomy | Combined with: |
|------------------|--------------------|---------------------------------------------|-----------------------------------|----------------|
|                  | Homolateral Neck Dissection | Bilateral Neck Dissection |                  |                |
| In General       | 48 (Norris)\textsuperscript{42} | 83 (Norris)\textsuperscript{42} | 60 (Quinn)\textsuperscript{34} |                  |
| T1A              | 40 (Quinn)\textsuperscript{34} | 50 (Quinn)\textsuperscript{34} | 61 (Ogura et al)\textsuperscript{24, 28, 53} | 68 (Som)\textsuperscript{54} |
| T1B              |                  | 65 (Ogura et al)\textsuperscript{24, 28, 53} | 73 (Som)\textsuperscript{54} |                  |
| T2               | 60 (Hendrickson)\textsuperscript{6} |                  | 79 (Bocca)\textsuperscript{36} |                  |
| Epiglottis       |                  |                  |                  |                |
| Supraglottic     | 66 (Ogura et al)\textsuperscript{24, 28, 53} |                  |                  |                |
| T3               |                  |                  |                  |                |
| T4               |                  |                  |                  |                |
The incidence of occult metastatic rate was 18 percent.

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Subtotal Supraglottic Laryngectomy for Cancer of the Epiglottis

Fig. 5. Remove the supraglottic larynx, pre-epiglottic space, hyoid bone, upper margin of the thyroid cartilage, and laryngeal tissue above the true cords. Excise only one arytenoid cartilage. To overcome aspiration, the true vocal cord must be fixed in the midline.

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