Supracricoid partial laryngectomy (SCL) is a horizontal partial laryngectomy technique. It should be considered under the topic of conservation surgery and not conservative surgery. Supracricoid laryngectomy was first introduced in Vienna in 1959 by Majer and Reider. Labayle and Bistmuth and Piquet refined the procedure in the 1970’s. Since that time, it has been successfully performed in Europe. It has since been carried out in Europe for quite some time. It was introduced in the United States in the 1990’s.

There are two types of SCL which are named by their reconstructive technique. They are the supracricoid partial laryngectomy with cricohyoidopexy (SCL-CHP) and the supracricoid partial laryngectomy with cricohyoidoepiglottopexy (SCL-CHEP). SCL-CHP is typically used in supraglottic lesions amenable to partial laryngectomy and SCL-CHEP is used in glottic lesions amenable to partial laryngectomy.

The idea of conservation laryngeal surgery is based on the pattern of spread of laryngeal malignancies and the anatomic compartmentalization within the larynx. Important anatomical concepts include the preepiglottic space and the paraglottic space. The preepiglottic space is defined superiorly by the hyoepiglottic ligament, anteriorly by the thyrohyoid membrane, inferiorly by the thyroepiglottic ligament and posteriorly by the epiglottis. The paraglottic space is bounded superiorly by the quadrangular membrane and medial piriiform sinus wall, inferiorly by the conus elasticus and laterally by the thyroid cartilage. Historically, it was accepted that the supraglottic and glottic larynx are separated by distinct connective tissue barriers which halt the spread of cancer based on dye studies by Pressman. However, clinicopathologic studies have shown that this is not always the case. Supraglottic cancers can invade transglottically along the medial surface of the thyroid ala and involve the paraglottic space. In addition, the anterior commissure provides another route of spread to the glottis and thyroid cartilage. In these cases, the standard supraglottic laryngectomy is contraindicated but supracricoid laryngectomy is still an option.
Supracricoid laryngectomy includes removal of the entire supraglottis, the false and true vocal cords, and the thyroid cartilage including the paraglottic and preepiglottic spaces. In addition, one arytenoid may be resected. The cricoid cartilage, hyoid bone, and at least one arytenoid are saved. Phonatory and swallowing function is maintained by the movement of the spared arytenoid against the tongue base. Respiratory function is dependent on the preservation of the cricoid cartilage. Preservation of these laryngeal functions form the basis of conservation (organ-preserving) surgery.

The indications for SCL are supraglottic cancers that: 1. involve the glottis and anterior commissure, 2. invade the ventricle, 3. are associated with impaired vocal cord mobility, 4. invade the thyroid cartilage 5. have paraglottic invasion, 6. have moderate preepiglottic space involvement. In addition, transglottic glottic carcinoma is another indication for SCL. Note that true hemilaryngeal fixation (vocal cord and arytenoids), base of tongue involvement, massive preepiglottic space or vallecular invasion, cricoid involvement (extent of tumor more that 10 mm anteriorly and 5 mm posteriorly), interarytenoid involvement, extensive thyroid cartilage involvement, inability to perform post-operative speech and swallowing rehabilitation instructions or inadequate pulmonary reserve are contraindications. Advanced age by itself is not a contraindication. Severe gastroesophageal reflux disease should raise concern for aspiration pneumonia.

Supracricoid laryngectomy is an alternative to total laryngectomy (TL) or radiation therapy (XRT) in selected supraglottic and glottic lesions. It is important to note that the AJCC staging system for laryngeal cancers is not a foolproof way to select candidates for SCL. Each case must be considered individually. Patients who have undergone SCL can be classified anywhere from T1b to T4 lesions with the majority of cases being performed on T2 or T3 lesions. Overall, studies on local control of supraglottic cancer treated by radiation therapy alone have shown higher local recurrence rates versus those treated with SCL. The differences in the local control rates between the two modalities become more defined with larger tumors. Multiple studies on SCL have shown it to be an effective treatment modality for selected supraglottic and glottic lesions versus total laryngectomy. Laccourreye believes that SCL should not only be considered for advanced laryngeal cancer in order to avoid total laryngectomy. Rather, any patient being considered for XRT or vertical partial laryngectomy should also be considered for SCL.

The preoperative assessment of SCL candidates includes a careful history and physical examination. Assessment of vocal cord mobility should be made by fiberoptic laryngoscopy. In cases of vocal cord fixation, differentiation of the site of fixation between the anterior two thirds and the arytenoid should be made. A fixed arytenoid is a contraindication to SCL. Videostrobe may be helpful in these cases. CT or MRI should be ordered as well as a chest x-ray and liver function tests to evaluated for distant metastases. A staging panendoscopy should be performed with attention to the mobility of the arytenoids and the extent of the tumor in all dimensions. In addition, assessment of the pulmonary status of the patient should be made clinically. If this status is in question, formal pulmonary function tests can be carried out. If PFT's are carried out, an
FEV1<50% of expected is a contraindication. It is important to counsel the patient with voice, swallowing expectations as well as consenting them for a TL. The patient should be told of the need for a temporary nasogastric tube and tracheostomy. The possibility of long term tracheostomy and percutaneous gastrostomy should be discussed.

The procedure of SCL begins with the standard apron incision and raising of subplatysmal flaps superiorly to 1 cm above the hyoid and inferiorly to the clavicles. The sternohyoid and thyrohyoid muscles are transected along the superior border to the thyroid cartilage. The medial laryngeal vessels are then ligated and the sternothyroid muscles are transected along the inferior border of the thyroid cartilage. Next the inferior constrictor muscles and external thyroid perichondrium are transected along the posterior border of the thyroid cartilage. Care is taken to preserve the posterior branch of the internal branch of the superior laryngeal nerve by incising the constrictors right on the thyroid cartilage. The pyriform sinuses are then released as in a total laryngectomy. The cricothyroid joints are disarticulated being careful to stay right on the joint to avoid damage to the RLN. The isthmus of the thyroid gland is then transected and blunt dissection along the anterior tracheal is performed to help mobilize the trachea to avoid tension on the final anastomosis. Next, the periosteum of the hyoid bone is incised and a Freer is used to dissect the preepiglottic space from the posterior surface of the hyoid bone. The larynx is then entered through the vallecula superiorly and inferiorly through the cricothyroid membrane immediately above the cricoid. At this time an endotracheal tube in inserted into the cricothyroid membrane. The larynx is grasped with an Allis clamp and the endolaryngeal cuts are made.

The endolaryngeal cut is begun on the non-tumor side. A vertical incision is made anterior to the arytenoid from the aryepiglottic fold to the cricoid using scissors. The entire paraglottic space is anterior to the cut and the pyriform sinus is posterior and spared. Care must be taken to adequately resect the entire paraglottic space as disease left at this site contributes to local failure. Next this incision and the CT incision are connected by transection of the CT muscle along the superior border of the cricoid. The thyroid cartilage is then grasped and fractured along the midline to open it like a book. Excision of the tumor bearing side is completed under direct visualization by completing the CT incision on that side and performing a vertical prearytenoid incision or if need be resecting a portion or the total arytenoid on that side.

Closure of the mucosa of only the upper part of the arytenoids is sutured. If the arytenoids is removed, no attempt should be made to cover the raw surfaces. The arytenoids(s) that remain should be pulled forward to the posterolateral part of the cricoid cartilage with a 2-0 Vicryl suture to avoid posterior sliding of the arytenoids. The hyoid bone and cricoid cartilage are then secured with three submucosal sutures of 0 Prolene. The midline one is placed first being careful to grab a bite of tongue base with this suture. The other two sutures are placed bilaterally 1 cm from the midline. The sutures are tagged with clamps. Next, a tracheotomy is performed and the previously tagged sutures are tied. Care must be taken to ensure the cricoid and hyoid anterior borders are well aligned. The sternohyoid muscles are reconstituted and the wound is closed in two layers.
Cricopharyngeal myotomy should be avoided in these patients because it predisposes the patients to gastroesophageal reflux disease which can lead to aspiration.

The N0 neck has been addressed in many ways depending on which study one is referencing. The most consistent recommendation is to perform bilateral selective neck dissections including levels II, III and IV for supraglottic tumors and unilateral II, III, IV dissection for glottic tumors. For N+ disease, more extensive neck dissections need to be performed (usually a MRND or RND). A study by Vincentiis, et. al. stated that the presence of N2 disease in the neck is a contraindication for SCL-CHP.

Post-operative care begins with the tracheostomy tube. Laccourreye advocated the placement of a cuffless tracheostomy tube at the end of the procedure. Other surgeons take the cuff down of the tracheostomy tube on post-operative day (POD) one. The lack of cuff is important in that it preserves an active cough reflex. The first attempt at removal of the tracheostomy tube is made at POD #3. Early stomal closure enhances mobilization of the arytenoid cartilage and allows for upward movement of the larynx with swallowing. Once decannulation is performed, the patient is encouraged to swallow their own secretions by the supraglottic swallowing technique. Once the patient is tolerates a pureed diet, the nasogastric tube is removed.

Oncologic results are generally good for SCL with local failure rates ranging from 0 to 7.19% from studies performed in Europe and the United States. It is interesting to note that most of the patients reported on in the Laccourreye studies on CHL from 1990 and 1993 received induction chemotherapy prior to resection. Since that time, other studies have been performed without the use of induction chemotherapy that have verified the low failure rate. Local failure rate was 7%, neck failure rate was found to be 7% and distant failure rate was 4% in Weinstein’s 2001 study of 25 patients who underwent SCL in the U.S. with 14 month follow-up. Vincentiis et. al studied 70 patients who underwent SCL with CHP. The local recurrence rate was 7.1%. Vincentiis group believes that massive involvement of the hyoidothyroepiglottic space or the inferior paraglottic space are contraindications to SCL.

In a 1998 study of 15 patients with local recurrence after SCL by Laccourreye et. al., dyspnea was noted to be the main presenting symptom. Other symptoms included dysphonia, otalgia, odynophagia, and a neck mass. Laryngoscopy showed submucosal hypertrophy most commonly. Other findings include cricoid stenosis, fixation of a prior mobile arytenoid, and ulceration of the cricoarytenoid region. CT findings most commonly revealed lysis of the cricoid cartilage and invasion of the cricoarytenoid region. Preepiglottic space and paraglottic space invasion were also noted. None of the local recurrences were noted to be unresectable and the patients were treated with salvage chemotherapy and XRT or total laryngectomy with or without induction chemotherapy.

A comparison of the quality of life following SCL versus total laryngectomy with TEP (tracheoesophageal puncture) was performed by Weinstein et. al in a prospective U.S. study of 31 patients. This study found the SCL had significantly higher domain scores than TL and TEP for physical function, physical limitation, general health, vitality,
social function, emotional limitations, and physical health summary on the SF-36 general health status measure. Higher domain scores were obtained in the categories of eating and pain using the Michigan Head and Neck Quality of Life for SCL patients. In addition, voice related quality of life was better in SCL patients than in patients with TL and TEP.

The most important major complication of SCL is intractable aspiration resulting in prolonged tracheostomy and a permanent gastric feeding tube or a completion laryngectomy. Delayed decannulation may also result from edema or stenosis. Edema can be treated with steroids and antibiotics as indicated. Stenosis is rare and may be treated with laser resection. Other complications include bleeding, infection, and fistula formation as well as laryngeal stenosis, hoarseness and inadequate voice.

The average time to decannulation was reported by Laccourreye in 1990 as 7 days. The nasogastric tube was left in place on average for 15 days. Normal deglutition defined by no weight loss or aspiration pneumonia was attained by 50 of the 67 patients by the end of the first post-operative month. Adequate phonation was achieved by the second postoperative month by all 67 patients in Laccourreye’s 1990 study. In a study by Vincentiis, et.al(1996), physiologic deglutination was achieved in 95.5 % of the 70 patients looked at who underwent SCL-CHP. In this same study, 92% were decannulated. In a retrospective review of 69 patients who underwent SCL(59 with CHEP and 10 with CHP) by Bron, et. al, no permanent tracheostomy was needed. Median decannulation time was 27 days. Nasogastric feeding tube was removed in the first postoperative month in 90% of patients. Only four patients required a total laryngectomy for chronic aspiration. No permanent gastrostomy was required and the maximum delay for nasogastric tube removal was 3 months. This study noted that none of the variables tested (age, type of operation, arytenoid resection, timing of the tracheostomy) significantly influenced the post-operative recovery.

In summary, supracricoid laryngectomy is a controversial subject. Based on studies to date, it appears to have an acceptable recurrence rate compared to alternatives of radiation therapy and total laryngectomy while preserving the functions of the larynx. However, it should be noted that patient selection is key to obtaining successful results with this operation.
Bibliography


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