

Main Article

Supracricoid partial laryngectomy with cricothyroidopexy and cricothyroidoepiglottopexy: functional and oncological results

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Abstract

Sixty-eight patients who presented with glottic and glottosupraglottic squamous cell carcinoma and who were managed in this department with supracricoid partial laryngectomy (SCPL) with either cricothyroidoepiglottopexy (CHEP) or cricothyroidopexy (CHP), were retrospectively reviewed. The authors analysed the functional and oncological results of the patients. The median follow-up period was 62 months. The average times until decannulation and nasogastric feeding tube removal were 27.7 and 26.4 days, respectively. All patients were successfully decannulated. All patients were able to swallow, but one patient was unable to swallow and had recurrent aspiration. Better functional results were achieved in patients managed with CHEP procedure than the patients managed with CHP procedure. The five-year absolute and cause-specific actuarial survival rates (Kaplan-Meier method) were 78.6 per cent and 93.9 per cent, respectively. The five-year actuarial local control and nodal control rates were 89.5 per cent and 90.4 per cent, respectively. Local recurrence was statistically more likely in patients with positive resection margins ($p < 0.006$). Overall, local control and laryngeal preservation were achieved in 95.6 per cent and 89.7 per cent, respectively. Supracricoid partial laryngectomy procedures (CHEP and CHP) are possible alternatives to total laryngectomy in the treatment of selected advanced glottic and glottosupraglottic carcinomas.

Key words: Laryngeal neoplasms; Carcinoma, Squamous Cell; Laryngectomy

Introduction

There are two basic goals of conservation laryngeal surgery for the otolaryngologist–head and neck surgeons. The first one is to achieve the same local control as total laryngectomy with complete surgical resection in compliance with oncological principles. The second one is to maintain deglutition, phonation and respiration, which are the physiological functions of the larynx.

Supracricoid partial laryngectomy (SCPL) with cricothyroidopexy (CHP) was first introduced as an alternative to total laryngectomy for the treatment of selected glottic and supraglottic cancers by Majer and Rieder in 1959.¹ Labayle and Bismuth² performed a successful SCPL with CHP in 1970. In 1974, Piquet *et al.* described reconstruction with cricothyroido-epiglottopexy (CHEP), which is a modification of Majer's technique for glottic carcinomas.³ The main surgical indication for SCPL with CHP is cancer of the vestibule

extending to the glottis, and for SCPL with CHEP is cancer of the glottis affecting the anterior commissure and the contralateral vocal fold with marked limitations, mobility or fixation of the vocal fold.⁴ SCPL with CHP involves resections of the entire thyroid cartilage, paraglottic spaces, epiglottis and pre-epiglottic space.^{5,6} SCPL with CHEP involves resections of the entire thyroid cartilage, paraglottic spaces and the inferior portion of the pre-epiglottic space. In this procedure, the upper two thirds of the epiglottis is conserved.^{6,7} However, the hyoid bone, cricoid cartilage, and at least one arytenoid cartilage are preserved in both techniques.^{5–7} These protected laryngeal structures provide continuity of speech, swallowing, and respiration without the need for a permanent tracheostomy. The preservation of a mobile arytenoid cartilage results in physiological speech and swallowing. Maintenance of the cricoid cartilage allows for decannulation, and provides the continuity of the respiratory functions.^{5,7}

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In this clinic, the authors have been performing SCPL procedures since 1985.⁸ In the present retrospective study, they analysed the functional and oncological results of 68 patients, who underwent SCPL with either CHP or CHEP.

Materials and methods

Sixty-eight patients underwent SCPL with CHP or CHEP for glottic and supraglottic carcinomas at this department between July 1985 and April 2003. All patients had squamous cell carcinoma. All patients except one were men. The median age was 54 (range 34 to 68). All patients underwent pre-operative microlaryngoscopic examination and most of them were endoscopically examined using 30° and 70° telescopes to assess possible involvement of the ventricles, the anterior commissure, and the subglottic region, and arytenoid mobility. A computed tomography scan (CT) was performed to assess involvement of the thyroid cartilage, pre-epiglottic and paraglottic spaces when there was suspicion.

The SCPL with CHP or CHEP was performed in 43 and 25 patients, respectively. In one patient, the SCPL with CHP was a salvage procedure after horizontal glottectomy (Caleoro). None of the patients had received previous radiation therapy. Functional ipsilateral neck dissection was performed in 39 patients, radical ipsilateral dissection in eight patients, and radical ipsilateral and functional contralateral dissection in five patients. The arytenoid cartilage on the tumour-bearing side was totally resected in 49 patients, and both arytenoid cartilages were spared in 19 patients.

The tumours were glottic and supraglottic in origin in 25 and 43 patients, respectively. The histological staging of these cases, according to the 1992 American Joint Committee on Cancer (AJCC) was as follows: eight were T₁N₀ (glottic); 41, T₂N₀ (16 glottic, 25 glottosupraglottic); three, T₂N₁ (glottosupraglottic); one, T₂N₂ (glottosupraglottic); six, T₃N₀ (one glottic, five glottosupraglottic); four, T₃N₁ (glottosupraglottic); and five, T₄N₀ (four glottosupraglottic, one local relapse). In the present series, the tumours classified as T₁ glottic involved anterior commissure in two patients and contralateral vocal fold with anterior commissure involvement in six patients. The tumours classified as T₂ glottic were unilateral in five patients and bilateral in 11 patients.

Neck movement was restricted in the early post-operative period (for two days). Voice exercises were started on the fifth day post-operatively and voice outloud between the sixth and ninth days. Swallowing exercises and exercises for the movement of the base of the tongue were started on the 10th day. On the 13th and 14th days feeding with jelly and puree were started. The nasogastric feeding tube was removed after the patient started to swallow liquid nutrition without any problems, and during the following days the patient was decannulated.

As a combined treatment, post-operative radiotherapy was performed in only one patient, who had a positive surgical margin and squamous cell carcinoma with basaloid features. All patients, whose neck specimens demonstrated nodal invasion, had no extracapsular spread of carcinoma. Thus, none of them received post-operative radiotherapy. Patients, who had positive surgical margins or nodal invasion without extracapsular spread, were closely followed up.

The median follow-up period was 62 months (range, four to 90 months). Statistical analysis was carried out using MINITAB Ver. 13.1 for the computer. Absolute and cause-specific survivals, local and nodal control, and post-operative functional parameters such as decannulation time, nasogastric tube removal, and hospital stay were analysed. Statistical analysis of functional results was performed by Independent-samples *t*-test. The Kaplan-Meier analysis was used to evaluate absolute survival, cause-specific survival, local control, and nodal control. The following independent factors: age, T-stage, type of operation, arytenoid cartilage resection, positive margins, local recurrence, and nodal recurrence were tested for local recurrence, nodal recurrence, and survival. The parametric χ^2 test and the non-parametric Mann-Whitney U test were used for the analysis of qualitative and quantitative variables, respectively. A *p* value below 0.05 was considered statistically significant.

Results

No patient died in the immediate post-operative period. Post-operative histopathological examination showed resection margins free of tumour in 63 patients (92.6 per cent) and with residual tumour in five (7.4 per cent). Metastatic lymph nodes in the neck specimens were found in eight of the 52 patients (11.8 per cent) with neck dissection. Post-operative complications were noted in 17.6 per cent of patients (Table I). Laryngeal necrosis and ruptured pexy were not encountered. Aspiration pneumonia was managed successfully with antibiotic therapy. However, in one patient, total laryngectomy was required due to persistent aspiration. Laryngeal stenosis was developed three months after the surgery in one patient with a successful decannulation. This patient underwent laryngeal stenting with a Montgomery T tube for six weeks. Other complications were treated successfully with conservative and medical treatments.

TABLE I
POST-OPERATIVE COMPLICATIONS (68 PATIENTS)

Complication	N	%
Surgical		
Wound infection	4	5.9
Pharyngeal fistula	1	1.5
Laryngeal stenosis	1	1.5
Medical		
Aspiration pneumonia	4	5.9
Deep venous thrombosis	1	1.5
Oesophageal bleeding	1	1.5

TABLE II
ANALYSIS OF FUNCTIONAL PARAMETERS

	NT* removal Days \pm SD*	<i>p</i> value	Decannulation Days \pm SD*	<i>p</i> value	Hospital stay Days \pm SD*	<i>p</i> value
Type of operation						
CHP*	29 \pm 11	0.06	30 \pm 12	0.24	35 \pm 12	0.03
CHEP*	22 \pm 6		24 \pm 6		26 \pm 6	
Arytenoid cartilage resection						
One resected	26 \pm 9	0.90	28 \pm 8	0.96	32 \pm 10	0.74
None resected	27 \pm 13		28 \pm 14		31 \pm 14	

* CHP = cricohyoidoepexy; CHEP = cricohyoidoepiglottopexy; NT = nasogastric tube; SD = standard deviation

Functional results

Decannulation. All patients were successfully decannulated. The mean decannulation time was 27.7 days (range: seven to 59 days).

Deglutition. All patients were able to swallow, but one patient was unable to swallow and had recurrent aspiration. In this patient, total laryngectomy had to be performed because of persistent aspiration pneumonia. In the remaining 67 patients, the nasogastric tube was removed after a mean duration of 26.4 days (range: 13–59 days).

Hospital stay. The mean duration of hospital stay was 31.6 days (range: 18–67 days). The average time in the hospital was prolonged in patients with complications.

Phonation. All patients except one, who underwent total laryngectomy, achieved physiological phonation. The quality of post-operative voice allowed normal social interaction.

A significant difference was found at functional results depending on the type of operation (Table II). The type of operation showed a statistically significant influence on the post-operative recovery, while preservation of both arytenoids did not significantly reduce these functional parameters (Table II).

Oncological results

Survival. The five-year absolute and cause-specific actuarial survival rates were 78.6 per cent and 93.9 per cent, respectively. Thirteen patients died in the post-operative follow-up. The causes of death were intercurrent disease (eight patients), second primary tumour (one patient), distant metastasis (one patient), associated local and nodal recurrence (two patients), and local recurrence (one patient). The five-year absolute survival rates for SCPL with CHP and CHEP were 74.5 per cent and 85.4 per cent, respectively. The five-year cause-specific actuarial survival rates for SCPL with CHP and CHEP were 92.5 per cent and 96 per cent, respectively. The five-year cause specific actuarial survival rate was 96.1 per cent among patients with T₁-T₂ tumours, and 84.6 per cent among patients with T₃-T₄ tumours. Univariate analysis revealed that only local recurrence had a statistically significant effect on survival. No statistical relationship was found between the other variables and the survival (Table III).

Local and nodal recurrences. Local laryngeal recurrence, local and nodal recurrence, and nodal recurrence occurred in four, three, and three patients, respectively. The local recurrences were noted after a period ranging from two to 17 months after surgery. The five-year actuarial local control rate was 89.5 per cent. The five-year actuarial local control rates for SCPL with CHP and CHEP were 90.5 per cent and 88 per cent, respectively. Salvage therapy for the laryngeal recurrences was performed by total laryngectomy in three patients, total laryngectomy with post-operative radiotherapy in three patients, and radiotherapy in one patient. Salvage therapy controlled local recurrence in four of seven patients. The overall local control rate was 95.6 per cent with a global laryngeal preservation rate of 89.7 per cent. The five-year actuarial local control rates for patients with T₁-T₂ tumours and T₃-T₄ tumours were 92.4 per cent and 79 per cent, respectively. Local recurrence was more likely if the margins of resection were positive (Table III).

The five-year actuarial nodal control rate was 90.4 per cent. The nodal recurrences were noted after a period ranging from two to 59 months. The six patients with nodal recurrence were treated with neck dissection and post-operative radiotherapy (three patients), and radiotherapy (three patients). The overall nodal control rate was 97 per cent. Univariate analysis revealed that the independent factor influencing nodal recurrence was local recurrence (Table III).

TABLE III
P VALUES OF THE UNIVARIATE ANALYSIS OF LOCAL RECURRENCE, NODAL RECURRENCE, AND SURVIVAL

Independent factors	Local recurrence	Nodal recurrence	Survival
Age	0.6	0.9	0.5
T stage	0.2	1	0.1
Type of operation	0.7	1	0.3
Arytenoid cartilage resection	0.09	0.3	1
Positive margins	0.006	0.4	0.05
Local recurrence	–	0.01	0.02
Nodal recurrence	–	–	0.3

Discussion

The SCPL procedures (CHP and CHEP) are organ preserving surgeries for the management of selected glottic and supraglottic laryngeal carcinomas.⁹ The surgical techniques and oncological indications and contraindications for both procedures have been described in the literature.^{5,7,10-13} In general, there are two sets of oncological indications, firstly to avoid total laryngectomy, and secondly to achieve the same local control as in total laryngectomy. The SCPL with CHEP has been used to manage T₁, T₂, and selected T₃ glottic carcinomas. The SCPL with CHP has been used to manage selected early (T₁-T₂) and advanced (T₃-T₄) supraglottic carcinomas. Arytenoid cartilage fixation, posterior commissure invasion, infraglottic extent of tumour reaching the upper border of the cricoid cartilage, cricoid cartilage invasion, and extralaryngeal spread of tumour must be considered as major oncological contraindications for both procedures. Pre-epiglottic space invasion is a major oncological contraindication to SCPL with CHEP but does not limit the use of SCPL with CHP.¹⁴

- **This paper retrospectively reviews 68 patients presenting with glottic and glottosupraglottic squamous cell carcinoma who were managed with supracricoid partial laryngectomy (SCPL) with either cricohyoidoepilottomy (CHEP) or cricohyoidoepexy (CHP)**
- **The median follow-up period was 62 months**
- **All patients were successfully decannulated**
- **All but one patient were able to swallow**
- **Better functional results were achieved in patients managed with the CHEP procedure**
- **Overall, local control and laryngeal preservation were achieved in 95.6 per cent (CHEP) and 89.7 per cent (CHP) respectively**
- **SCPL procedures (CHEP and CHP) are possible alternatives to total laryngectomy in treatment of selected advanced glottic and glottosupraglottic carcinomas**

The reported five-year absolute and cause-specific actuarial survival for selected 'early and/or advanced' glottic and supraglottic endolaryngeal carcinomas treated with SCPLs vary from 66.5 per cent to 84.7 per cent^{6,11,15-17} and from 80.1 per cent to 95.6 per cent,^{6,16,17} respectively. In a review of 104 patients with glottic carcinomas classified as T₁ to T₃, Piquet and Chevalier¹¹ have reported a 93 per cent five-year cause-specific survival rate after SCPL with CHEP. In an analysis of 112 patients with glottic carcinomas classified as T₂ to T₃ with fixation or impaired motion of the true vocal fold managed with induction chemotherapy and SCPL with CHEP,

Chevalier *et al.*¹⁷ have reported a 95.6 per cent five-year cause-specific survival rate. In a series of 69 patients with early and advanced laryngeal carcinomas managed with SCPLs, Bron *et al.*⁶ have reported an 83.2 per cent and 51.4 per cent five-year cause-specific survival rates for CHEP and CHP, respectively. De Vincentiis *et al.*¹⁰ reported a 90.7 per cent three-year cause-specific survival rate after SCPL with CHP. Another study presented the Guerrier technique of modified subtotal laryngectomy with CHEP to manage T₁-T₂ glottic carcinomas, three-year and five-year cause specific survival rates were reported as 95 per cent and 90.8 per cent, respectively.¹⁶ In general, it was reported by authors that tumour size has no effect on the survival.^{11,15-17} The present results were in agreement with the previous reports. There was a 93.9 per cent five-year cause specific survival rate. The five-year cause-specific survival rates for SCPL with CHP and CHEP were 92.5 per cent and 96 per cent, respectively. Also, they found a 96.1 per cent and 84.6 per cent five-year cause specific survival rate for patients with T₁-T₂ and T₃-T₄ tumours, respectively.

The rate of local laryngeal recurrences in most studies range from 0.0 per cent⁵ to 16 per cent.⁶ Seven (10.3 per cent) patients in this series had a local laryngeal recurrence, resulting in a five-year actuarial local control rate of 89.5 per cent. After salvage treatment, the overall local control rate was 95.3 per cent for patients managed with SCPL with CHP, and 96 per cent for patients managed with SCPL with CHEP.

The reported data suggest that SCPLs allowed high local control and survival rates. Thus, SCPLs have been advocated in patients with selected 'advanced' endolaryngeal carcinoma to avoid total laryngectomy and is to be preferred in patients with selected 'early' endolaryngeal carcinoma instead of conventional modalities (vertical partial laryngectomy, supraglottic partial laryngectomy and radiotherapy).^{5-7,10,11,17-19} The authors' results corroborated these data with the achievement of an 89.5 per cent five-year actuarial local control rate, a 93.9 per cent five-year cause specific survival rate, and an overall 89.7 per cent laryngeal preservation rate.

The functional goal of both procedures is to provide speech and swallowing without a permanent tracheostomy.⁹ The functional results were quite satisfactory (Table II). Normal laryngeal function was achieved in 49 out of 68 patients (72 per cent) by the end of the first post-operative month. Univariate analysis revealed that only the type of operation had a significant influence on the functional parameters. Better functional results were achieved in patients managed with the CHEP procedure. Although many studies reported that sparing of both arytenoids improves functional results,^{15,20,21} our results did not support such data. Also, multiple recent reports proposed early (in the first post-operative week) decannulation for successful rehabilitation of swallowing after SCPLs.^{7,20,21} But the authors have preferred decannulation after deglutition without aspiration to minimize the risk of serious pulmonary complications led by early post-operative aspiration.

The most frequently reported complication from these procedures is aspiration pneumonia. The rate of post-operative aspiration pneumonia varies from 0 per cent⁷ to 21.7 per cent.^{6,10,20,22} Aspiration pneumonia occurred in four of our patients (5.9 per cent). Pneumonia was managed successfully with antibiotic therapy. Only one patient had to undergo total laryngectomy because of recurrent aspiration.

Generally, many studies reported that there were no increased age-related contraindications.^{5-7,19} The SCPLs have been advocated in the elderly patient (older than 65 years of age) by Laccourreye *et al.*²² In the present series, the oldest patient, in whom SCPL with CHEP was performed, was 68 years. In this patient, the authors have had excellent functional results. The main contraindication for both procedures is pre-operative evidence of severe respiratory impairment.¹³

Conclusion

If the indications are applied scrupulously, CHEP and CHP are possible alternatives to total laryngectomy in the treatment of glottic and glotto-supraglottic carcinomas. The present study confirmed the principles of SCPL for selected advanced carcinomas.

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