International Journal of Otorhinolaryngology and Head and Neck Surgery
Luna-Ortiz K et al. Int J Otorhinolaryngol Head Neck Surg. 2025 Aug;11(4):396-400
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937
DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20252248

Short Communication

Management of supraglottic tumors using carbon dioxide laser

Kuauhyama Luna-Ortiz[1]*, Gabriela A. Guillén-Hernández[1], Miguel Á. Álvarez-Avitia[2], Zelik Luna-Peteuil[3], Dorian Y. García-Ortega[4]

[1]Department of Head and Neck Surgery, Instituto Nacional de Cancerología, Mexico
[2]Department of Medical Oncology, Instituto Nacional de Cancerología, Mexico
[3]Medical School at Universitatea de Medicină și Farmacie "Grigore T. Popa", Romania
[4]Department of Surgical Oncology, Instituto Nacional de Cancerología, Mexico

Received: 09 February 2025
Revised: 13 May 2025
Accepted: 30 June 2025

***Correspondence:**
Dr. Kuauhyama Luna-Ortiz,
E-mail: kuauhyama@yahoo.com.mx

ABSTRACT

Laryngeal cancer has a high mortality rate in Mexico and worldwide. Supraglottic cancer, in particular, accounts for many cases, and treatment varies based on the clinical stage of the disease, the medical center's expertise, and the economic and human resources. A retrospective study was conducted between 2005 and 2023 on 14 patients with supraglottic squamous cell carcinoma. Most patients were male (85%), with an average age of 68.5 years, and the same percentage were smokers. Endoscopic carbon dioxide (CO_2) laser resections were performed either alone, with induction chemotherapy, or as a salvage method following chemotherapy and radiotherapy. Laryngeal preservation was achieved in 92% of cases, with only one patient requiring total laryngectomy due to recurrence. Follow-up showed promising results, as most patients remained free of active disease for several years. Although some experienced local and regional recurrences, endoscopic CO_2 laser surgery allowed for laryngeal preservation in many cases. Additionally, induction chemotherapy followed by endoscopic surgery also proved effective in advanced stages, yielding favorable oncological and functional outcomes. Endoscopic CO_2 laser surgery is a reliable option for preserving the larynx in supraglottic cancer, even in advanced stages. Its oncological outcomes are comparable to those reported in the literature, offering a high rate of organ preservation and favorable long-term functional outcomes.

Keywords: Supragglotis, Cancer, Larynx, CO_2 Laser

INTRODUCTION

Laryngeal cancer ranks 22nd in incidence and 18th in mortality worldwide, with 189,191 new cases and 103,359 deaths. In Mexico, it ranks 24th in incidence and 21st in mortality, with 1,139 new cases and 726 deaths, accounting for roughly 1% of all cancers. The incidence and mortality rates are higher in Europe (5.45 new cases per 100,000 people) and the Americas (3.37 new cases per 100,000 people).[1,2]

Supraglottic cancer accounts for 33% of cases of laryngeal cancer in countries like France, Italy, the Netherlands, Finland, and Uruguay, a proportion similar to that observed in Mexico. At our institution, 8% of cases are diagnosed at early clinical stages (I-II), while 92% are diagnosed at advanced stages (III-IV). Additionally, only 59% of patients receive some form of treatment.[1-4]

Treatment will depend on the clinical stage (CS), the medical center's expertise, and available resources. For early stages (T1, T2, N0) and some selected T3 cases, patients may be candidates for laryngeal preservation through open resection, endoscopic resection, or, more recently, robotic surgery, with or without induction chemotherapy (ICT), while definitive radiotherapy (RT) can also be considered. In cases of locally advanced (LA) or very advanced disease, total laryngectomy (TL) remains

a viable option, particularly with the availability of voice prostheses, followed by adjuvant RT or not.[5-10]

This study aims to describe the use of endoscopic surgery with or without ICT and as a salvage method.

METHODS

We conducted a retrospective study of 17 patients with supraglottic cancer who underwent endoscopic resection at our institution between January 2005 and December 2023. The study was approved by the institution's ethics committee under approval number 2024/078. Clinical staging was performed using physical examination, nasofibrolaryngoscopy (NFL), and computed tomography (CT) of the neck, larynx, and chest. Three patients were excluded due to having a histology other than squamous cell carcinoma, leaving 14 patients diagnosed with this condition. Based on clinical staging, patients underwent either initial endoscopic resection or resection following ICT. Those who had previously received CT/RT were considered for salvage surgery. ICT was administered based on a cisplatin-paclitaxel-fluorouracil (PPF) regimen consisting of cisplatin (80 mg/m^2) on day 1, paclitaxel (80 mg/m^2) on days 1, 8, and 15, and 5-fluorouracil (5-FU) (800 mg/m^2) on days 1–4.[7] This schedule was repeated every 21 days for a total of two cycles via continuous infusion. Treatment response was evaluated using NFL and CT.

Endoscopic surgery was performed using suspension laryngoscopy with CO_2 laser resection. Neck dissection was also carried out, mostly bilaterally from levels II to V, with a focus on identifying the Delphian lymph node. Patients who had received definitive chemotherapy (CT) or radiotherapy (RT) did not undergo this procedure.[11,12]

Follow-up was conducted every 3 months for 2 years, then every 6 months for the following 3 years, and every year starting from the fifth year.

RESULTS

Of the 14 patients, 12 (85%) were male and 2 (15%) were female. The average age was 68.5 years (range 47-90). Among the patients, 85% were smokers. Surgery was performed on the following subsites: 3 cases of suprahyoid epiglottis, 3 cases of subhyoid epiglottis, 4 cases of aryepiglottic folds, and 4 cases of false vocal cords. Initial surgery was performed on 5 patients (36%), while 9 patients (64%) underwent surgery following ICT (5) or as a salvage procedure (4 with CT/RT).

Patients were admitted on the day of surgery, which was performed under general anesthesia with orotracheal intubation and CO_2 laser resection set at a power of 4–11 W. They were able to start eating 6 hours after the procedure. None of the patients required a nasogastric tube, gastrostomy, or a tracheostomy. The length of hospital stay ranged from 0 to 2 days. Patients who did not undergo lymph node resection were discharged on the same day, and no surgical complications were reported.

Table 1 summarizes the treatments based on the classification for supraglottic resections.[13] Among the 14 patients, 5 (36%) were in the early stage and underwent initial surgery, while 9 (64%) had locally advanced disease. Negative margins were obtained in all cases. One patient who initially underwent surgery received adjuvant radiotherapy due to N+ with extranodal extension. Two patients experienced local recurrence: one underwent a second resection and is currently disease-free, while the other, deemed unsuitable for another resection, underwent total laryngectomy with primary voice prosthesis placement and remains disease-free to this day (Tables 1 and 2).

Five patients underwent surgery after ICT, and four received salvage surgery after CT/RT. Among the ICT patients, one died due to toxicity and another from distant disease. The remaining seven patients are alive and disease-free. A supracricoid laryngectomy was performed on one of them. Organ preservation was achieved in all cases. Three patients did not require lymph node dissection as their surgery was done after definitive CT/RT with complete tumor removal. One patient had regional recurrence in the lymph nodes and required selective neck dissection (Table 1).

The organ preservation rate was 92%, with only one patient requiring total laryngectomy after 24 months. Despite local recurrence in three patients, they are still alive and disease-free after 157 months (range 116–197 months). Two patients died from nodal disease (associated with toxicity), and one died from distant disease (lung), with an overall survival (OS) of 36 months (range 19–54 months) (Table 2).

Table 1: Primary site, stage and type of treatment.

S. no.	Subsite	T	N	M	Induction	Type of resection	Neck dissection	Margins	Adj	Recurrence/ treatment
1	False vocal cord	1	0	0	No	I	Left SND	Negative	No	Yes, local, laser re-resection
2	Right aryepiglottic fold	1	0	0	No	I	No	Negative	No	No

Continued.

S. no.	Subsite	T	N	M	Induction	Type of resection	Neck dissection	Margins	Adj	Recurrence/ treatment
3	Suprahyoid epiglottis	4a	0	0	TPF (2)	IVa	Bilateral SND	No residual tumor	No	No
4	False vocal cord	3	3a	0	TPF (3)	IVb	Bilateral SND	No residual tumor	No	Yes, LN, RT
5	Left aryepiglottic fold	3	0	0	TPF (2)	I	Left SND	Residual, negative margins	No	Yes, local, SCPL-CHEP
6	Right aryepiglottic fold	3	1	0	TPF (2) + CT/RT	VI	No	No residual tumor	No	Yes, LN, lung, SND + CT
7	False vocal cord	1	0	0	No	I	No	Negative	No	No
8	Infrahyoid epiglottis	2	0	0	No	IVa	Bilateral SND	Negative	Yes, RT	Yes, local, total laryngectomy + voice prosthesis
9	Suprahyoid epiglottis	3	0	0	CDDP/ PACLI/5FU (3)+CT/RT	VI	No	Residual, negative margins	No	No
10	Suprahyoid epiglottis	1	0	0		I	No	Negative	No	No
11	Left aryepiglottic fold	3	0	0	CBP (2) + RT	VI	Bilateral SND	No residual tumor	No	No
12	Infrahyoid epiglottis	1	2c	0	Carbo/pacli (3) + RT	VI	No	Residual, negative margins	No	No
13	Suprahyoid epiglottis	3	1	0	TPF (3)	IVa	Bilateral SND	No residual tumor	No	No
14	False vocal cord	3	0	0	TPF (2)	IIIb	Bilateral SND	Residual, negative margins	No	No

*Adj=adjuvant treatment; Sx=surgery; SND=selective neck dissection; LN=lymph nodes; RT=radiotherapy; TPF=cisplatin-paclitaxel-fluorouracil; CBP=carboplatin-paclitaxel; CT/RT=chemotherapy/radiotherapy; SCPL-CHEP=supracricoid partial laryngectomy-cricohyoidoepiglottopexy

Table 2: Treatment and follow-up.

Px	Initial treatment	Local, regional recurrence, disease-free period (months)	Distant recurrence (months)	Treatment	Overall survival (months)	Cause of death
1	Sx	Yes, local, 36	No	Laser re-resection	197	No
2	Sx	No, 36	No	-	40	No
3	ICT	No, 147	No	-	147	No
4	ICT	Yes, LN, 4	No	RT	19	RT toxicity
5	ICT	Yes, local, 4	No	SCPL-CHEP	116	No
6	CT+ CT/RT	Yes, LN, 24	Yes, lung, 24	Palliative CT	54	Distant disease
7	Sx	No, 12	No	-	14	No
8	Sx	Yes, local, 24	No	Total laryngectomy	159	No
9	CT + CT/RT	No, 11	No	-	14	No
10	Sx	No, 12	No	-	14	No
11	CT+RT	No, 33	No	-	43	No
12	CT+RT	No, 29	No	-	77	No
13	ICT	No, 36	No	-	45	No
14	ICT	No, 11	No	-	12	No

*Sx=surgery; LN=lymph nodes; ICT=induction chemotherapy; RT=radiotherapy; RT=radiotherapy; CT/RT=chemotherapy/radiotherapy; SCPL-CHEP=supracricoid partial laryngectomy-cricohyoidoepiglottopexy

DISCUSSION

The incidence of laryngeal cancer appears to be lower in Latin America compared with other parts of the world, accounting for approximately 1% of cancers in Mexico. Supraglottic cancer represents 33% of cases of laryngeal cancer in countries like France, Italy, the Netherlands, Finland, and Uruguay, a proportion similar to that observed in Mexico. At our institution, 8% of cases are diagnosed at early clinical stages (I-II), while 92% are diagnosed at advanced stages (III-IV). Additionally, only 59% of patients receive some form of treatment.[1-4,14]

The gold standard for treating early-stage supraglottic cancer was horizontal supraglottic laryngectomy, often combined with radical neck dissection. However, with the introduction of supraglottic tumor resections using suspension laryngoscopy by Vaughan in 1978, followed by Steiner's popularization of CO_2 laser resection in 1979, this approach became the preferred method. Its advantages, such as being a viable transoral procedure that eliminates the need for a tracheostomy contributed to its widespread adoption. This method has also led to an increase in endoscopic resection rates from 7% to 20% while reducing total laryngectomy rates from 19% to 14%, all while maintaining oncological outcomes and 5-year survival rates for supraglottic cancer across all stages at 47-52%.[4,8,15,16]

Some studies report that larynx preservation can be achieved in up to 89% of cases. Of these, 91% are classified as pT1, 97% as pT2, 89% as pT3, and 69% as pT4a. The rate of secondary laryngectomy due to residual tumors in patients who are not candidates for a second resection ranges from 0% to 4%. Steiner et al. reported a local control rate of 80% and a 5-year survival rate of 49% in patients with clinical stages III and IV treated with laser resection, with or without adjuvant radiotherapy.[9,17,18] We performed endoscopic resections on 5 patients in stages I and II, two of whom developed recurrence. One patient underwent a second resection, while the other had a total laryngectomy and was fitted with a voice prosthesis.

We administered induction therapy followed by surgery to 5 patients. Since the 1980s, induction chemotherapy has been used for organ preservation in advanced stages, although its use has declined over time. Nevertheless, we continue to use it, especially in open surgery. More recently, we have adopted a combination of induction therapy and endoscopic CO_2 laser surgery.[12]

Induction chemotherapy followed by transoral laser resection in patients with locally advanced or very advanced disease has proven feasible, producing favorable oncological and functional outcomes. Chang et al reported that 27% of patients achieved a pathologic complete response, while 73% had a partial response. The three-year oncological outcomes included an overall survival rate of 89%, cancer-specific survival of 78%, recurrence-free survival of 73%, and an organ preservation rate of 91%.[19]

In five patients, induction chemotherapy was followed by endoscopic partial supraglottic laryngectomy. One patient experienced recurrence and underwent open partial laryngectomy, preserving the larynx and remaining alive. Another patient had regional recurrence and ultimately died due to toxicity.

The benefits of performing endoscopic CO_2 laser resection in cases of recurrence are well-documented, including in patients receiving induction chemotherapy followed by surgery or those undergoing definitive chemotherapy/ radiotherapy, particularly in the latter group, where total laryngectomy was often performed as a salvage procedure.[20,21] In a study of 199 patients, Weiss demonstrated the feasibility of performing laser resection in 145 patients (72.9%).[22] None of our patients developed local recurrence; however, one patient had regional recurrence. This raises the question of whether neck dissection is necessary for these patients or, at the very least, whether routine ultrasound and fine-needle aspiration biopsy should be considered, even for patients who have received radical radiotherapy. No prospective studies have compared oncological outcomes for supraglottic cancer across different treatments. However, comparative and retrospective studies have found no differences in survival or local control. Although we are a referral center, we cannot draw definitive conclusions due to the small number of cases in our study.[15,16,19]

All patients were discharged the day after surgery and resumed eating 6 hours post-operation without complications. However, complications related to endoscopic CO_2 laser surgery have been reported in 2.2% of cases, with hemorrhage being the most common. Other possible complications include vestibular stenosis, aspiration, and recurrent pneumonia, which may require total laryngectomy for functional reasons (reported in 3.5-12.5% of cases).[17]

CONCLUSION

Supraglottic laryngeal cancer is rare in our population. However, in early stages, treatment with endoscopic surgery, combined with a multidisciplinary approach and CO_2 laser resection for organ preservation in locally advanced cases, achieves larynx preservation rates comparable to those seen with salvage surgery. Further multicenter studies are needed to confirm our findings.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Nocini R, Molteni G, Mattiuzzi C, Lippi G. Updates on larynx cancer epidemiology. Chin J Cancer Res. 2020;32(1):18-25.

2. Herrera-Gómez A, Villavicencio-Valencia V, Rascón-Ortiz M, Luna-Ortiz K. Demographic data of laryngeal cancer at the Instituto Nacional de Cancerología in Mexico City. Cir Cir. 2009;77(5):353-7.
3. Dyckhoff G, Warta R, Herold-Mende C, Rudolph E, Plinkert PK, Ramroth H. An Observational Cohort Study on 194 Supraglottic Cancer Patients: Implications for Laser Surgery and Adjuvant Treatment. Cancers. 2021;13:568.
4. Hoffman HT, Porter K, Karnell LH, Cooper JS, Weber RS, Langer CJ, et al. Laryngeal cancer in the United States: changes in demographics, patterns of care, and survival. Laryngoscope. 2006;116(9 Pt 2 Suppl 111):1-13.
5. Matos LL, Kowalski LP, Chaves ALF, de Oliveira TB, Marta GN, Curado MP, et al; HEADSpAcE Consortium. Latin American Consensus on the Treatment of Head and Neck Cancer. JCO Glob Oncol. 2024;10:e2300343.
6. Gökmen MF, Büyükatalay ZÇ, Beton S, Gökcan MK, Dursun G, Meço C, et al. Functional and Oncological Outcomes of Open Partial Laryngectomy vs. Transoral Laser Surgery in Supraglottic Larynx Cancer. Turk Arch Otorhinolaryngol. 2020;58(4):227-33.
7. Thomas L, Drinnan M, Natesh B, Mehanna H, Jones T, Paleri V. Open conservation partial laryngectomy for laryngeal cancer: a systematic review of English language literature. Cancer Treat Rev. 2012;38(3):203-11.
8. Ambrosch P, Gonzalez-Donate M, Fazel A, Schmalz C, Hedderich J. Transoral Laser Microsurgery for Supraglottic Cancer. Front Oncol. 2018;8:158.
9. Gomez-Pedraza A, Luna-Ortiz K. Oncological approach for laryngeal cancer. J Cancerol. 2015;2:99-112.
10. Lechien JR. Surgical, Functional, and oncological outcomes of transoral robotic surgery for cT1-T3 supraglottic laryngeal Cancers: A systematic review. Oral Oncol. 2024;159:107047.
11. Luna-Ortiz K, Mosqueda-Taylor A. Delphian lymph node in glottic carcinoma subjected to supracricoid partial laryngectomy with cricohyoidoepiglottopexy. Cirugía y Cirujanos. 2005;73:7-10.
12. Luna-Ortiz K, Reynoso-Noveron N, Zacarias-Ramon LC, Alvarez-Avitia M, Luna-Peteuil Z, Garcia-Ortega DY. Supracricoid Partial Laryngectomy With and Without Neoadjuvant Chemotherapy in Glottic Cancer. Laryngoscope. 2022;132(1):156-62.
13. Luna-Ortiz K, Gomez-Pedraza A, Garcia-Ortega DY, Pasche P. Supraglottic laryngectomy for endoscopic resection: proposal of a new classification. Int J Otorhinolaryngol Head Neck Surg. 2022;8(4):397-401.
14. Wünsch Filho V. The epidemiology of laryngeal cancer in Brazil. Sao Paulo Med J. 2004;122(5):188-94.
15. Steiner W. Results of curative laser microsurgery of laryngeal carcinomas. Am J Otolaryngol. 1993;14(2):116-21.
16. García Lorenzo J, Montoro Martínez V, Rigo Quera A, Codina Aroca A, López Vilas M, Quer Agustí M, et al. Modifications in the treatment of advanced laryngeal cancer throughout the last 30 years. Eur Arch Otorhinolaryngol. 2017;274(9):3449-55.
17. Grant DG, Salassa JR, Hinni ML, Pearson BW, Hayden RE, Perry WC. Transoral laser microsurgery for carcinoma of the supraglottic larynx. Otolaryngology–Head and Neck Surg. 2007;136:900-6.
18. Ambrosch P, Fazel A. Functional organ preservation in laryngeal and hypo-pharyngeal cancer. GMS Curr Top Otorhinolaryngol Head Neck Surg. 2011;10:Doc02.
19. Chang CF, Wang LW, Yang MH, Chu PY. Induction chemotherapy followed by transoral laser microsurgery with or without adjuvant therapy for advanced hypopharyngeal cancer patients: A preliminary result. J Chin Med Assoc. 2024;19:38904335.
20. Department of Veterans Affairs Laryngeal Cancer Study Group; Wolf GT, Fisher SG, Hong WK, Hillman R, Spaulding M, Laramore GE, et al. Induction chemotherapy plus radiation compared with surgery plus radiation in patients with advanced laryngeal cancer. N Engl J Med. 1991;324(24):1685-90.
21. Spector ME, Rosko AJ, Swiecicki PL, Chad Brenner J, Birkeland AC. From VA Larynx to the future of chemoselection: Defining the role of induction chemotherapy in larynx cancer. Oral Oncol. 2018;86:200-5.
22. Weiss BG, Bertlich M, Canis M, Ihler F. Transoral laser microsurgery or total laryngectomy for recurrent squamous cell carcinoma of the larynx: Retrospective analysis of 199 cases. Head Neck. 2017;39(6):1166-76.

Cite this article as: Luna-Ortiz K, Guillén-Hernández GA, Álvarez-Avitia MA, Luna-Peteuil Z, García-Ortega DY. Management of supraglottic tumors using carbon dioxide laser. Int J Otorhinolaryngol Head Neck Surg 2025;11:396-400.