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Prognostic Impact of Primary Tracheostomy in Laryngeal Squamous Cell Carcinoma: A Retrospective Comparative Study

Bensimimou S*, Benghaleb H, Aboutalib A, Lahjaouj M, Loudghiri M, Bijou W, Oukessou Y, Rouadi S, Abada RL, Roubal M and Mahtar M

Department of Otorhinolaryngology and Head and Neck Surgery, 20 August 1953 Hospital, Ibn Rochd University Hospital, Casablanca, Morocco

ABSTRACT

Background: Laryngeal squamous cell carcinoma (LSCC) is a prevalent head and neck malignancy with significant morbidity and mortality. Primary tracheostomy is frequently required for acute airway obstruction; however, its prognostic implications remain poorly characterized, particularly in North African settings where advanced-stage presentation is prevalent.

Objectives: To compare oncological and postoperative outcomes between LSCC patients who underwent primary tracheostomy and those who did not.

Methods: Retrospective comparative study of 100 patients who underwent surgery for histologically confirmed LSCC at the 20 August 1953 University Hospital in Casablanca, Morocco (January 2017–December 2023). Patients were stratified by tracheostomy status. Categorical variables were compared using Chi-square and Fisher's exact tests.

Results: The cohort was 97% male, mean age 63 ± 10 years; 82% were active smokers. Primary tracheostomy was performed in 58% of patients, all of whom subsequently underwent total laryngectomy. All-cause mortality was significantly higher in the tracheostomy group (46.6% vs. 16.7%, p = 0.002), and disease-free survival was markedly lower (48.3% vs. 81.0%, p = 0.001). Pharyngocutaneous fistula (8.6% vs. 0%, p = 0.018) and radiomucositis (19.0% vs. 4.8%, p = 0.037) were significantly more frequent in tracheostomized patients.

Conclusion: Primary tracheostomy is associated with significantly poorer oncological and postoperative outcomes in LSCC, reflecting advanced tumor burden at presentation. Early diagnosis, timely adjuvant radiotherapy, and multidisciplinary management are essential to improve prognosis in this high-risk population.

***Corresponding author**

Bensimimou S, Department of Otorhinolaryngology and Head and Neck Surgery, 20 August 1953 Hospital, Ibn Rochd University Hospital, Hassan II University, Casablanca, Morocco.

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Introduction

Laryngeal cancer accounts for approximately 30% to 40% of head and neck malignancies and 1% to 2.5% of all malignant neoplasms worldwide [1,2]. It predominantly affects middle-aged men, with tobacco and alcohol representing the principal etiological risk factors [3]. Squamous cell carcinoma (SCC) is the most common histological subtype, representing more than 90% of laryngeal malignancies [3]. Prognosis is influenced by tumor extent, locoregional spread, and the therapeutic approach, including the necessity for emergency airway management [4,5]. Primary tracheostomy is frequently required in patients with laryngeal SCC presenting with acute airway obstruction not amenable to conservative medical management [6]. While it remains a life-saving emergency procedure, its prognostic implications remain debated. Concerns have been raised regarding potential tumor seeding through the tracheostomy site, impairment of locoregional disease control, and increased postoperative morbidity [7,8]. Alternative airway management strategies, such as endoscopic CO_2 laser debulking, have been proposed to avoid or defer tracheostomy in selected cases [9].

Evidence specifically addressing the oncological impact of primary tracheostomy in laryngeal SCC is limited, and North African data are particularly scarce. [10]. The aim of this study was to describe the clinical and therapeutic profile of patients operated on for laryngeal SCC at a Moroccan tertiary referral center and to compare oncological and postoperative outcomes between patients who underwent primary tracheostomy and those who did not.

Materials and Methods

Study Design and Setting

This was a retrospective descriptive and analytical study conducted at the Department of Otorhinolaryngology and Head and Neck Surgery, 20 August 1953 Hospital, Ibn Rochd University Hospital,

in Casablanca, over the period January 2017 to December 2023.

Ethics Statement

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of 20 August 1953 Hospital. Written informed consent was obtained from all participants prior to inclusion. All patient data were handled with strict confidentiality throughout the study.

Study Population

One hundred consecutive patients operated on for histologically confirmed laryngeal squamous cell carcinoma were included. Exclusion criteria were: incomplete medical records, non-squamous cell carcinoma histology, and loss to follow-up prior to any oncological outcome assessment. Patients were stratified into two groups based on whether primary tracheostomy was performed before definitive surgical treatment.

Data Collection

Data were retrospectively extracted from patients'medical records. Variables collected included patient demographics, comorbidities, toxic habits (tobacco, alcohol), symptom duration, clinical and endoscopic findings, computed tomography characteristics, histopathological grade, surgical approach, adjuvant treatment modalities, and postoperative complications. Formal TNM staging according to AJCC criteria was not systematically documented across the study period, a recognized limitation of the retrospective design. Tumor involvement level was classified based on direct suspension laryngoscopy (DL) and computed tomography findings.

Outcome Definitions

The primary outcome was all-cause mortality, defined as death from any cause recorded at last available medical follow-up. Secondary outcomes were:

- Disease-free survival, defined as the absence of documented local recurrence or distant metastasis at last available follow-up;
- Local recurrence rate; and
- Postoperative complications, including pharyngocutaneous fistula, tracheostomy site infection, aspiration pneumonia, radiodermatitis, radiomucositis, and chemotherapy-related adverse events. Due to incomplete documentation of follow-up dates, actuarial survival analysis (Kaplan–Meier) could not be performed; crude rates at last available follow-up are reported.

Statistical Analysis

Categorical variables were compared using the Chi-square test or Fisher's exact test as appropriate. Continuous variables were compared using Student's t-test. Proportions are reported with 95% confidence intervals (CI) calculated using the Wilson score method. All tests were two-tailed, and a p-value < 0.05 was considered statistically significant. Due to the limited sample size, multivariate logistic regression could not be reliably performed. Univariate analysis was used to identify factors significantly associated with primary tracheostomy. Statistical analyses were performed using IBM SPSS Statistics version 20.

Results

Baseline Characteristics

The study included 100 patients, predominantly male (97%), with a mean age of 63 ± 10 years (range: 42–93 years). Active smoking (tobacco alone or in combination with alcohol) was reported in 82% of patients overall. Tobacco use alone was reported in 67.2% of the tracheostomy group versus 59.5% of the non-tracheostomy group; tobacco-alcohol association in 17.2% versus 19.0% respectively. Comorbidities included diabetes mellitus (5%), hypertension (4%), and pulmonary tuberculosis (5%). The mean duration of symptoms before initial consultation was 12 months in both groups. Both groups were comparable in terms of age, sex, smoking habits, and comorbidities ($p > 0.05$ for all). Full baseline characteristics are presented in Table 1.

Table 1: Baseline characteristics and comparison between patients who underwent primary tracheostomy and those who did not

Variable	Tracheostomy (n=58)	No Tracheostomy (n=42)	p-value
Demographics			
Age, mean ± SD* (years)	63.4 ± 9.95	62.7 ± 9.95	0.719
Male sex, n (%)	56 (96.6%)	41 (97.6%)	1.000
Tobacco only, n (%)	39 (67.2%)	25 (59.5%)	0.427
Tobacco + alcohol, n (%)	10 (17.2%)	8 (19.0%)	0.817
No toxic habit, n (%)	9 (15.5%)	9 (21.4%)	0.599
Medical Comorbidities			
Diabetes mellitus, n (%)	2 (3.4%)	3 (7.1%)	0.407
Hypertension, n (%)	3 (5.2%)	1 (2.4%)	0.469
Pulmonary tuberculosis, n (%)	3 (5.2%)	2 (4.8%)	0.926
Clinical Presentation			
Mean symptom duration (months)	12	12	1.000
Dysphonia, n (%)	57 (98.3%)	40 (95.2%)	0.571
Dyspnea, n (%)	56 (96.6%)	13 (31.0%)	< 0.001
Dysphagia, n (%)	9 (15.5%)	3 (7.1%)	0.203
Tumor Involvement — Computed Tomography (CT Scan)			

Supraglottic involvement only, n (%)	5 (8.6%)	11 (26.2%)	0.018
Glotto-supraglottic, n (%)	20 (34.5%)	12 (28.6%)	0.532
Glotto-subglottic, n (%)	5 (8.6%)	4 (9.5%)	1.000
Three-level involvement, n (%)	20 (34.5%)	6 (14.3%)	0.023
Surgical Management			
Total laryngectomy, n (%)	58 (100.0%)	25 (59.5%)	< 0.001
Partial laryngectomy, n (%)	0 (0.0%)	17 (40.5%)	< 0.001

Clinical Presentation and Tumor Characteristics

Dysphonia was the predominant presenting symptom (97%), followed by dyspnea (69%) and dysphagia (12%). Endoscopic examination revealed a predominantly exophytic tumor appearance on nasofibroscopy (97%), and an ulcerative-exophytic pattern on direct laryngoscopy (98%). Overall tumor involvement was limited to the supraglottic level in 15%, the glottic level in 24%, and multilevel involvement in 61% of cases. On computed tomography, isolated supraglottic involvement was observed in 16% of patients, glottic in 17%, glotto-subglottic in 9%, glotto-supraglottic in 32%, and three-level involvement in 26%.

Primary tracheostomy was required in 58% of patients due to acute upper airway obstruction not manageable by conservative medical treatment. Dyspnea was markedly more frequent in the tracheostomy group (96.6% vs. 31.0%, $p < 0.001$), and three-level laryngeal involvement was significantly more common in tracheostomized patients (34.5% vs. 14.3%, $p = 0.023$). Conversely, isolated supraglottic involvement was significantly more frequent in the non-tracheostomy group (26.2% vs. 8.6%, $p = 0.018$).

Histopathological analysis of biopsy specimens demonstrated a predominance of well-differentiated SCC (68%), followed by moderately differentiated carcinoma (25%), verrucous carcinoma (5%), and poorly differentiated carcinoma (2%). Surgical margins were clear in all operative specimens.

Surgical Management and Adjuvant Treatment

Total laryngectomy with bilateral neck dissection was performed in 83% of patients and partial laryngectomy in 17%. All 58 tracheostomized patients subsequently underwent total laryngectomy (100%), while none of the patients treated with partial laryngectomy had required prior tracheostomy ($p < 0.001$). Among patients undergoing total laryngectomy, 69.9% had previously undergone primary tracheostomy. Adjuvant radiotherapy was administered to 36 patients, and concurrent chemoradiotherapy to 11 patients. Chemotherapy-related adverse effects (nausea and vomiting) were observed only in the tracheostomy group (5.2% vs. 0%), suggesting a higher rate of chemoradiotherapy administration in this group, consistent with a greater tumor burden.

Oncological and Postoperative Outcomes

A total of 34 patients (34%) died during the study period. All-cause mortality was significantly higher in the tracheostomy group (27/58, 46.6% [95% CI: 33.8–59.4%]) versus the non-tracheostomy group (7/42, 16.7% [95% CI: 7.0–31.4%], $p = 0.002$). Disease-free survival was significantly lower in tracheostomized patients (28/58, 48.3% [95% CI: 35.5–61.1%] vs. 34/42, 81.0% [95% CI: 66.6–91.0%], $p = 0.001$). Local recurrence was observed in 10.3% of tracheostomized patients versus 4.8% of non-tracheostomized patients, a difference that did not reach statistical significance ($p = 0.521$). Among patients with local recurrence, 75% had experienced delays in initiating adjuvant radiotherapy.

Pharyngocutaneous fistula occurred in 5 tracheostomized patients (8.6% [95% CI: 2.9–19.0%]) and in none of the non-tracheostomized patients ($p = 0.018$). Radiomucositis was significantly more frequent in the tracheostomy group (19.0% [95% CI: 9.9–31.4%] vs. 4.8% [95% CI: 0.6–16.2%], $p = 0.037$). Tracheostomy site infections (13.8% vs. 4.8%, $p = 0.251$), radiodermatitis (17.2% vs. 11.9%, $p = 0.461$), aspiration pneumonia (17.2% vs. 7.1%, $p = 0.138$), and chemotherapy-related nausea and vomiting (5.2% vs. 0%) did not reach statistical significance. Complete outcome data are presented in Table 2.

Table 2: Comparison of oncological outcomes and postoperative complications between groups, with 95% confidence intervals (Wilson score method)

Variable	Tracheostomy (n=58) n (%)	No Tracheostomy (n=42) n (%)	p-value
Oncological Outcomes			
All-cause mortality †	27 (46.6%) [95% CI: 33.8–59.4%]	7 (16.7%) [95% CI: 7.0–31.4%]	0.002
Disease-free survival ‡	28 (48.3%) [95% CI: 35.5–61.1%]	34 (81.0%) [95% CI: 66.6–91.0%]	0.001
Local recurrence	6 (10.3%) [95% CI: 3.9–21.2%]	2 (4.8%) [95% CI: 0.6–16.2%]	0.521
Postoperative Complications			
Tracheostomy site infection	8 (13.8%) [95% CI: 6.1–25.4%]	2 (4.8%) [95% CI: 0.6–16.2%]	0.251
Pharyngocutaneous fistula	5 (8.6%) [95% CI: 2.9–19.0%]	0 (0.0%) —	0.018
Aspiration pneumonia	10 (17.2%) [95% CI: 8.6–29.4%]	3 (7.1%) [95% CI: 1.5–19.5%]	0.138
Radiotherapy-Related Complications			
Radiodermatitis	10 (17.2%) [95% CI: 8.6–29.4%]	5 (11.9%) [95% CI: 4.0–25.6%]	0.461
Radiomucositis	11 (19.0%) [95% CI: 9.9–31.4%]	2 (4.8%) [95% CI: 0.6–16.2%]	0.037

Chemotherapy-Related Complications			
Nausea and vomiting	3 (5.2%) [95% CI: 1.1–14.4%]	0 (0.0%) —	0.262

† All-cause mortality at last available medical follow-up. ‡ Disease-free survival: absence of documented local recurrence or distant metastasis at last available follow-up. All p-values calculated by Chi-square or Fisher's exact test. Bold p-values indicate statistical significance ($p < 0.05$). —: not applicable (zero events in both cells).

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Univariate Analysis

Nine factors were significantly associated with primary tracheostomy on univariate analysis ($p < 0.05$): dyspnea ($p < 0.001$), isolated supraglottic involvement (more frequent in the non-tracheostomy group, $p = 0.018$), three-level laryngeal involvement ($p = 0.023$), total laryngectomy ($p < 0.001$), partial laryngectomy (more frequent without tracheostomy, $p < 0.001$), all-cause mortality ($p = 0.002$), disease-free survival ($p = 0.001$), pharyngocutaneous fistula ($p = 0.018$), and radiomucositis ($p = 0.037$). Age, sex, smoking habits, alcohol use, comorbidities, and other tumor localization patterns showed no statistically significant inter-group differences.

Discussion

In our series, primary tracheostomy was performed in 58% of patients, markedly higher than rates reported in all comparable published series (Table 3): 35.5% by Carrillo et al. 31.4% by Byrd et al., 23.7% by Gong et al. and 10% by Masmoudi et al [4,7,8,10]. This elevated rate likely reflects several converging factors: the advanced-stage presentation characteristic of our cohort, evidenced by a prolonged diagnostic delay of 12 months and multilevel tumor involvement in 61% of cases; the tertiary referral nature of our institution, which systematically concentrates the most complex and obstructive cases; and the broader North African epidemiological context, where laryngeal cancer ranks among the five most common male malignancies and patients frequently present late due to limited awareness of early laryngeal symptoms and significant socioeconomic barriers [10,11].

Table 3: Comparison of Primary Tracheostomy Rates and Oncological Outcomes Across Published Series of Laryngeal Squamous Cell Carcinoma

Study (Year)	Country	N	Trach. rate	Overall Survival—Trach. vs No Trach. (p)	Disease-Free Survival—Trach. vs No Trach. (p)	PCF rate
Carrillo et al. [7] (1999)	Mexico	NR	35.5%	5-yr OS: 20% vs 80% (p=0.002)	—	48.1%†
Herchenhorn et al. [5] (2008)*	Brazil	49	NR	Median OS: 12 mo vs 56 mo (p<0.001) [3-yr DSS: 6% vs 61%, p=0.001]	Median DFS: 7 mo vs not reached	—
Byrd et al. [8] (2018)	USA	226	31.4%	5-yr OS: 48.8% vs 72.0% (p=0.03)	5-yr DFS: ↓ significantly (p=0.02)	—
Gong et al. [4] (2021)	China	413	23.7%	5-yr OS: 49.3% vs 69.8%	5-yr DFS: 45.3% vs 61.0%	—
Estomba et al. [19] (2017)*	Spain	21	NR	3-yr OS: 25% vs 38.5% (p=0.551)	—	—
Present study (2024)	Morocco	100	58%‡	53.4% vs 83.3% (p=0.002)§	48.3% vs 81.0% (p=0.001)	8.6% vs 0% (p=0.018)

OS: overall survival. DSS: disease-specific survival. DFS: disease-free survival. PCF: pharyngocutaneous fistula. mo: months. NR: not reported. —: not reported in original publication. * CRT cohort (chemoradiotherapy), not surgical series; tracheostomy in Estomba et al. refers to post-CRT persistent tracheostomy. † PCF rate for entire surgical cohort (not stratified by tracheostomy status). ‡ Highest primary tracheostomy rate in comparative international literature. § Equivalent to all-cause mortality of 46.6% vs 16.7% (p=0.002). Byrd et al. per-group values as reported in the thesis; PubMed abstract reports 48.8% OS for entire cohort. Gong et al. p-values for OS and DFS not extracted from available data. Bold row: present study.

These advanced-stage presentations were reflected in the oncological outcomes. All-cause mortality was significantly higher in the tracheostomy group (46.6% vs. 16.7%, $p = 0.002$), and disease-free survival was correspondingly lower (48.3% vs. 81.0%, $p = 0.001$). These findings are consistent across the published literature. Byrd et al. reported significantly decreased overall survival ($p = 0.03$) and disease-free survival ($p = 0.02$) in pretreatment tracheotomy patients across a multi-institutional cohort of 226 patients [8]. Carrillo et al. identified tracheostomy as an independent prognostic factor on multivariate analysis, with five-year survival rates of 20% versus 80% ($p = 0.002$) [7]. In the largest available comparative series (N = 413), Gong et al. demonstrated that preoperative tracheotomy was independently associated with worse five-year overall survival (49.3% vs. 69.8%) and disease-free survival (45.3% vs. 61.0%) in advanced glottic carcinoma [4]. It must be emphasized, however, that in the absence of multivariate analysis and complete TNM staging data, primary tracheostomy should be interpreted as a marker of disease severity rather than an independent causal determinant of survival.

Against this backdrop, reducing the rate of primary tracheostomy through earlier airway management remains a relevant objective. Endoscopic CO_2 laser debulking prior to total laryngectomy represents a potential alternative in selected patients with obstructive laryngeal SCC, as demonstrated by Semdaie et al. in T4a laryngeal cancer [9]. However, current ASCO guidelines specify that for patients with extensive T3 or T4a disease and/or poor pretreatment laryngeal function, precisely the profile of our tracheostomized patients, total laryngectomy may offer superior survival and quality-of-life outcomes over organ-preservation strategies [12]. Endoscopic debulking should therefore be reserved for carefully selected cases in whom airway patency can be secured without compromising oncological resectability, based on multidisciplinary team assessment and strict tumor morphology criteria.

Beyond overall survival, locoregional control deserves specific attention. Local recurrence was numerically more frequent in tracheostomized patients (10.3% vs. 4.8%), without reaching statistical significance ($p = 0.521$), likely reflecting insufficient statistical power. Notably, 75% of patients with local recurrence had experienced delays in initiating adjuvant radiotherapy, a finding of critical clinical relevance. A systematic review of 23 studies demonstrated that postoperative radiotherapy delays exceeding six weeks are significantly associated with worse overall survival, recurrence-free survival, and locoregional control in head and neck squamous cell carcinoma, a finding further confirmed in a large National Cancer Database analysis specifically addressing laryngeal and hypopharyngeal cancer [13,14]. The landmark Cooper et al. randomized trial established that concurrent postoperative chemoradiotherapy significantly improves locoregional control and disease-free survival in high-risk HNSCC [15].

Regarding surgical morbidity, pharyngocutaneous fistula (PCF) occurred in 8.6% of tracheostomized patients versus 0% in the non-tracheostomy group ($p = 0.018$). This relatively contained rate is partly explained by the predominance of surgery-first patients without prior irradiation in our cohort, a well-established protective factor. It nonetheless contrasts markedly with the 48.1% reported by Carrillo et al., where prior radiotherapy was prevalent, and is consistent with the 14.3% reported in the Paydarfar and Birkmeyer meta-analysis [7,16]. A comprehensive systematic review and meta-analysis of 52 studies encompassing 8,605 patients reported an overall PCF incidence of 21% after total laryngectomy, identifying prior tracheostomy as an independent risk factor alongside previous radiotherapy, advanced T-stage, preoperative hypoalbuminemia, and anemia [17]. Notably, after primary total laryngectomy, as in the majority of our cohort, PCF incidence ranges from 8% to 25%, substantially lower than after salvage laryngectomy (14–57%) [17].

Radiomucositis was significantly more frequent in the tracheostomy group (19.0% vs. 4.8%, $p = 0.037$). According to current MASCC/ISOO clinical practice guidelines, oral and oropharyngeal mucositis affects virtually all patients receiving head and neck radiotherapy, with severe grades occurring in 80–100% of those undergoing concurrent chemoradiotherapy [18]. The higher radiomucositis rate in the tracheostomy group likely reflects greater tumor burden requiring more intensive radiation fields and a higher rate of concurrent chemotherapy administration, consistent with the chemotherapy-related adverse effects observed exclusively in this group.

Limitations

This retrospective study carries several inherent limitations. The absence of systematic TNM staging precludes stage-adjusted survival analysis and limits comparability with international series. Incomplete follow-up documentation prevented actuarial Kaplan–Meier estimation; crude outcome rates are reported accordingly. The limited sample size precluded multivariate logistic regression, restricting causal inference regarding independent prognostic factors. Finally, the non-randomized design introduces an unavoidable selection bias, as tracheostomized patients represent by definition a more advanced disease subset.

These limitations are common to retrospective research in resource-limited settings and are shared by the majority of published series on this topic. They do not undermine the clinical relevance of the findings, which represent one of the largest North African comparative series on primary tracheostomy in laryngeal SCC.

Conclusion

Primary tracheostomy in laryngeal squamous cell carcinoma is associated with significantly higher all-cause mortality, lower disease-free survival, and greater postoperative morbidity. It should be regarded primarily as a marker of advanced tumor burden at presentation rather than an independent prognostic determinant. The tracheostomy rate of 58% observed in our North African cohort - the highest reported in the comparative international literature — reflects the persistent challenge of late-stage presentation and underscores the urgent need for earlier laryngeal cancer detection within the Moroccan healthcare context. Timely initiation of adjuvant radiotherapy and coordinated multidisciplinary oncological management are paramount to optimizing outcomes. In selected patients, endoscopic CO_2 laser debulking may represent a viable alternative to primary tracheostomy and warrants further prospective evaluation. Prospective multicenter studies with standardized TNM staging, actuarial survival analysis, and structured long-term follow-up are needed to confirm these findings and establish evidence-based clinical recommendations [19].

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Declarations

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Ethics Approval and Consent to Participate: This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of 20 August 1953 Hospital. Written informed consent was obtained from all participants prior to inclusion.

Consent for Publication: Written informed consent for publication was obtained from all participants.

Competing Interests: The authors declare no competing interests.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, et al. (2021) Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 71: 209-249.
2. Parkin DM, Pisani P, Ferlay J (1999) Estimates of the worldwide incidence of 25 major cancers in 1990. Int J Cancer 80: 827-841.
3. Righini CA, Karkas A, Morel N, Soriano E, Reyt E (2008) Risk factors for cancers of the oral cavity, pharynx and larynx. Presse Med 37: 1229-1240.
4. Gong H, Zhou L, Wu C, Hsueh CY, Tao L, et al. (2021) Preoperative tracheotomy as reflection of tumor size impacting oncologic outcomes of patients with advanced stage glottic carcinoma. Eur Arch Otorhinolaryngol 278: 4943-4950.
5. Herchenhorn D, Dias FL, Ferreira CG, Araújo CM, Lima RA, et al. (2008) Impact of previous tracheotomy as a prognostic factor in patients with locally advanced squamous cell carcinoma of the larynx submitted to concomitant chemotherapy and radiation. ORL J Otorhinolaryngol Relat Spec 70: 381-388.
6. Durbin CG (2010) Tracheostomy: why, when and how?. Respir Care 55: 1056-1068.
7. Carrillo JF, Frías Mendívil M, Lopez Graniel C, Beitia AI, Ochoa Carrillo FJ (1999) Impact of preoperative tracheotomy on T3 transglottic laryngeal carcinoma. Eur Arch Otorhinolaryngol 256: 78-82.
8. Byrd SA, Xu MJ, Cass LM, Wehrmann DJ, Naunheim M, et al. (2018) Oncologic and functional outcomes of pretreatment tracheotomy in advanced laryngeal squamous cell carcinoma: a multi-institutional analysis. Oral Oncol 78: 171-176.
9. Semdaie D, Haroun F, Casiraghi O, Bidault F, Temam S, et al. (2018) Laser debulking or tracheotomy in airway management prior to total laryngectomy for T4a laryngeal cancer. Eur Arch Otorhinolaryngol 275: 1869-1875.
10. Masmoudi M, Thabet W, Zitouni C, Chebil A, Hasnaoui M, et al. (2010) Facteurs pronostiques des carcinomes épidermoïdes non métastatiques du larynx. J Tunis ORL 25: 31-35.
11. Belbaraka R, Barrimi S, Loughlimi H, Abkari M, El Mesbahi O (2022) Incidence trends of cancer in Morocco: the tale of the oncological center of Marrakech over 8 years. J Cancer Epidemiol 2022: 3307194.
12. Forastiere AA, Ismaila N, Lewin JS, Nathan CA, Adelstein DJ, et al. (2018) Use of larynx-preservation strategies in the treatment of laryngeal cancer: American Society of Clinical Oncology clinical practice guideline update. J Clin Oncol 36: 1143-1169.
13. Sun YP, Yao JJ, Mao YP, Lan XW, Sun Y (2023) Influence of time between surgery and adjuvant radiotherapy on prognosis for patients with head and neck squamous cell carcinoma: a systematic review. Head Neck 45: 1756-1770.
14. Tam S, Amit M, Zafereo M, Bell D, Weber RS (2018) The impact of adjuvant chemoradiotherapy timing on survival of head and neck cancers. Laryngoscope 128: 2326-2332.
15. Cooper JS, Pajak TF, Forastiere AA, Jacobs J, Campbell BH, et al. (2004) Postoperative concurrent radiotherapy and chemotherapy for high-risk squamous-cell carcinoma of the head and neck. N Engl J Med 350: 1937-1944.
16. Paydarfar JA, Birkmeyer NJ (2006) Complications in head and neck surgery: a meta-analysis of postlaryngectomy pharyngocutaneous fistula. Arch Otolaryngol Head Neck Surg 132: 67-72.
17. Wang Y, Liu M, Cao J, Zhang D, Wen ZL, et al. (2020) Risk factors of pharyngocutaneous fistula after total laryngectomy: a systematic review and meta-analysis. Eur Arch Otorhinolaryngol 277: 1-12.
18. Elad S, Cheng KKF, Lalla RV, Yarom N, Hong C, et al. (2020) MASCC/ISOO clinical practice guidelines for the management of mucositis secondary to cancer therapy. Cancer 126: 4423-4431.
19. Chiesa Estomba CM, Betances Reinoso FA, Martinez Villasmil V, González Cortés MJ, Santidrian Hidalgo C (2017) Persistent Tracheostomy after Organ Preservation Protocol in Patients Treated for Larynx and Hypopharynx Cancer. Int Arch Otorhinolaryngol 21: 377-381.