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Original Article

Survival and Disease-free Survival in Laryngeal Cancer and their Associated Factors in Western Saudi Arabia: A retrospective, single center study

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Abstract

Objective: To analyze overall survival (OS) and disease-free survival (DSF) in laryngeal cancer and to investigate the associated clinical and management factors.

Methods: This retrospective study included 50 patients who followed for malignant laryngeal cancer at a tertiary care center in Jeddah, Saudi Arabia, from 2008 up to April 2019. Baseline clinical and pathological characteristics, management data and outcomes were collected. Overall survival was defined as the time from diagnosis to last follow up; while DFS was calculated as the time from diagnosis to relapse or last follow up in case of no relapse. Kaplan-Meier survival analysis and Cox regression were used to analyze OS and DFS and the related factors.

Results: At last follow up, 10 (20.0%) patients were alive with disease and 12 (24.0%) were deceased. Five-year survival rate was 24.0% (95% CI=13.1, 38.2). Mean (95% CI) overall survival time was 11.38 (4.95 – 17.80) years and mean (95% CI) DFS was 8.64 (3.43 – 13.85) years. Surgery was associated with longer survival (mean=12.55 vs. 4.26 years; p=0.043) and DFS (10.0 vs. 2.36 years; p=0.044). Relapse (5.17 vs. 13.73 years; p=0.049) and metastasis (5.83 vs. 18.52 years; p=0.045) were associated with reduced mean overall survival. Smoking was associated with reduced mean DFS (5.14 vs. 7.25 years; p=0.050). None of the previous factors was significant in multivariate Cox regression model.

Conclusions: Survival rates were low compared to other regions. Relapse, metastasis, and smoking were associated with worse survival, while performing a primary surgical intervention was associated with better survival profiles.

Keywords: Larynx; Laryngeal; Cancer; Survival; Mortality; Saudi Arabia

Abbreviations

CI: Confidence interval

CT: Chemotherapy

DALYs: Disability-adjusted life years

DFS: Disease-free survival

GERD: Gastroesophageal reflux disease

KAUH: King Abdul-Aziz University Hospital

LC: Laryngeal cancer

OR: Odd ratio

OS: Overall survival

P75: 75th centile

RT: Radiotherapy

SD: Standard deviation

SEER (program): Surveillance, Epidemiology, and End Results (program)

TLM: Transoral laser microsurgery

Introduction

Laryngeal cancer (LC) is a rare type of cancer that can involve different sub-anatomical regions of the larynx. It has variable presentation patterns and therapeutic approaches, besides differences in the epidemiological picture. For instance, the prevalence rate of primary glottic LCs is three times higher than supraglottic LC, while subglottic presentation is extremely rare (2% of all LCs) [1]. Furthermore, glottic tumors typically present at early stages as hoarseness; while supraglottic tumors are more commonly manifested later with a profound pain and difficult swallowing [2]. Distant metastasis can be present in approximately 10% of the cases and lymph nodes are involved in 25%-50% of the patients; whereas 66% of the patients would have localized lesions at diagnosis [1].

Recent global estimates show a significant decline of disease burden over the past two decades. In 2015, disability-adjusted life years (DALYs) were estimated to be 37.6 compared to 57.7 DALYs per 100,000 population in 1990 [3]. Such a pattern coincides with reduced smoking rates during the same period. Similarly, LC-attributable mortality dropped from 1.70% to 1.53% between 1990 and 2015. Very recently, in 2019, according to data from the Surveillance, Epidemiology, and End Results (SEER) program and the American Cancer Society, the numbers of new cases and deaths due to LC in the United State were estimated to be 12,410 and 3,760, respectively [4,5]. Additionally, comparative analyses revealed higher incidence among males than females and among blacks than whites [1]. In Saudi Arabia, based on the Saudi Cancer Registry in 2016 (n=69), [6] the crude incidence rate of LC was 0.7 in males and 0.1 in females per 100,000 accounting for 1.20% of all cancers in both sexes.

As such, the variability in LC clinical characteristics coupled with its low incidence created multiple challenges related to treatment individualization, and yielded large gaps in the prospected outcomes. For instance, the United Kingdom National Multidisciplinary guidelines recommend radiotherapy coupled with transoral laser microsurgery (TLM) for supraglottic and glottic LC presenting at early stages (i.e., stage I or II), while a concurrent chemoradiotherapy is recommended as alternative for surgery. On the other hand, open surgery is indicated in selected patients [2]. Other recent recommendations indicated a single approach, whether radiotherapy or surgery in the early stages [7,8]. However, appropriate decision of treatment is usually based on meticulous discussions within multidisciplinary teams. Such uncertainty has been associated with conflicting outcomes regarding the efficacy and safety of surgical versus non-surgical modalities as well as survival outcomes following treatments.

Therefore, there is a requirement to assess the survival profiles of LC in different regions and settings. The variability of treatment opportunities and prognostic outcomes further supports this requirement. Given the scarcity of data from Saudi Arabia, providing insights into patients' survival with respect to the heterogeneous clinical characteristics, low incidence, variable treatment recommendations, and the increasing trend of smoking would not only achieve significant benefits to healthcare planning, but will also help conduct future reliable research studies, such as meta-analyses. In this context, the present study aimed at analyzing the survival and disease-free survival in a tertiary care center located in the Western region of Saudi Arabia, and investigating the stage of the disease at diagnosis, the anatomic location, and the received treatment as factors and predictors of survival, besides other factors.

Methods

Design and Setting

This retrospective study was carried out at the Otolaryngology-Head and Neck Surgery Department of King Abdul-Aziz University Hospital (KAUH), Jeddah, Saudi Arabia.

Population

We included all patients aged 12 years and above, who were followed up at the participating center for malignant laryngeal cancer, which was diagnosed before 31 December 2017. Patients

who had benign laryngeal tumor and those who were diagnosed after 31 December 2017 were excluded.

Data collection

Data collection was carried out between January and April 2019. It comprised the following: 1) Baseline demographic and clinical data including age at diagnosis, gender, nationality, smoking status, history of gastroesophageal reflux disease [GERD], alcohol, and family history of laryngeal cancer; 2) pathological characteristics including date of diagnosis, tumor site (glottic, subglottic, supraglottic, transglottic), histological type (carcinoma in situ, squamous cell carcinoma, etc.), grade (low versus high); 3) Management data including surgery (endoscopic resection, partial or total laryngectomy +/- lymph node resection), chemotherapy, radiation therapy, and combined therapy, with date of each procedure, where applicable, in addition to tracheotomy; 4) Outcomes including the occurrence and location of metastasis, relapse (recurrence or progression), and or death, and the date of each event, where available, and the date of last follow up were documented with the status at last follow up (alive without disease, alive with disease or deceased). Data was collected and processed with strict anonymity and confidentiality.

Outcome definition

Survival was defined as the time from diagnosis to last follow up or death; while disease-free survival was calculated as the time from diagnosis to relapse or death, whichever applicable, or to last follow up in case of no relapse or death.

Statistical methods

Statistical analysis was performed with the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Categorical variables are presented as frequency and percentage, while discrete variables are presented as mean ± standard deviation (SD) for normally distributed variables and median, 75th centile (P75) for non-normally distributed ones. Kaplan-Meier survival analysis was carried out to explore survival (event=death) and disease-free survival (event=relapse or death) and their associated factors; results were presented as mean (95% confidence interval [95% CI]) survival with Log-rank level. Cox regression analysis was carried out using a multivariate model to explore independent factors of survival and disease-free survival; results were presented as odds ratio (OR) with 95% CI. A p value of ≤0.05 was considered to reject the null hypothesis.

Ethical consideration

The study was approved by the institutional review board of King Abdul-Aziz University.

Results

Baseline demographic and clinical characteristics

Fifty patients were included. Mean (SD) age of the total population was 53.56 (16.22) years. Majority of the patients were males (43, 86.0%) and non-Saudi (31, 62.0%). Smoking was reported in 11 (22.0%) and GERD in 22 (44.0%). The most common tumor site was supraglottic (13, 26.0%) or transglottic (13, 26.0%), followed by glottic (12, 24.0%). Squamous cell carcinoma was the most frequent histological type diagnosed in 38 (76.0%) patients, and tumor grade was high in 12 (20.0%) of the cases. Notably, pathological data was missing in 5-12 (10.0%-24.0%) cases (Table 1).

Parameter	Category	Frequency	Percentage
Demographic data			
Gender	Male	43	86.0
	Female	7	14.0
Age at diagnosis (years)	Mean, SD (range 12, 86)	53.56	16.22
Nationality	Saudi	19	38.0
	Non-Saudi	31	62.0
Risk factors			
Smoking	No	32	64.0
	Yes	11	22.0
	Unknown	7	14.0
GERD	No	26	52.0
	Yes	22	44.0
	Unknown	2	4.0
Alcohol	No	50	100.0
Family history	No	42	84.0
	Unknown	8	16.0
Pathological data			
Tumor site	Glottic	12	24.0
	Supraglottic	13	26.0
	Subglottic	4	8.0
	Transglottic	13	26.0
	Glottic & Subglottic	3	6.0
	Not specified	5	10.0
Histological type	Carcinoma in situ	3	6.0
	Squamous cell carcinoma	38	76.0
	Miscellaneous carcinoma	1	2.0
	Not specified	8	16.0
Grade	Low	28	56.0
	High	10	20.0
	Undetermined or missing	12	24.0
Results are frequencies, percentages, except if otherwise specified; SD: standard deviation; GERD: gastroesophageal reflux disease			

Table 1: Baseline demographic and clinical characteristics.

Management and outcomes

Majority of the patients underwent surgery (36, 72.0%), and the most common procedures included endoscopic resection (18, 36.0%), total laryngectomy (12, 24.0%) and regional lymph node resection (5, 10.0%). Further, 25 (50.0%) and 29 (58.0%) patients benefited from chemotherapy and radiotherapy, respectively. Overall, 15 (30.0%) patients benefitted from surgery combined with chemotherapy and radiotherapy; 7 (14.0%) from surgery plus radiotherapy, 6 (12.0%) from chemotherapy plus radiotherapy; while 14 (28.0%) benefitted from surgery only and five (10.0%) had no therapy. Mean and median time from diagnosis to treatment was 6.31 months and 1.25 months, respectively (Table 2).

Outcomes showed the rates of metastasis (12 patients, 24.0%) and relapse (16, 32.0%), including recurrence (5, 10.0%) and progression (12, 24.0%). At last follow up, 28 (56.0%) were alive without disease, 10 (20.0%) were alive with disease, and 12 (24.0%) were deceased; and death occurred after a median (P75) time = 18.75 (76.94) months. Further, 5-year survival rate was 24.0% (95%CI=13.1; 38.2%) (Table 2).

Parameter	Category	Freq.	%
Management			
Surgery	No	14	28.0
	Yes	36	72.0
	Endoscopic resection (laser)	18	36.0
	Partial Laryngectomy	1	2.0
	Total Laryngectomy	12	24.0
	Regional lymph node resection	5	10.0
Time to surgery (months)	Mean, SD	6.81	13.61
	Median, P75	1.00	5.75
	Range	0.00	60.75
Chemotherapy	No	25	50.0
	Yes (Cisplatin)	25	50.0
Time to 1st session (months)	Mean, SD	8.67	11.53
	Median, P75	5.38	13.13
	Range	0.25	46.25
Radiation therapy	No	21	42.0
	Yes	29	58.0
Overall management	No therapy	5	10.0
	Chemotherapy only	3	6.0
	Surgery only	14	28.0
	Surgery & Radiation	7	14.0
	Radiation & Chemotherapy	6	12.0
	All three	15	30.0
Time to treatment	Mean, SD	6.31	12.59
	Median, P75	1.25	5.75
	Range	0.00	60.75
Laryngectomy	None	18	36.0
	After surgery	21	42.0
	Without surgery	11	22.0

Outcomes			
Metastasis	No	38	76.0
	Yes*	12	24.0
	Lung	9	18.0
	Lymph node	4	8.0
	Liver	2	4.0
	Bone	2	4.0
	Mediastinal	1	2.0
Relapse	None	34	68.0
	Yes	16	32
	Progression	12	24.0
	Recurrence	5	10.0
Time to relapse (months)	Median, P75	6.88	13.63
Death	N, %	12	24.0
	Time to death (median, P75)	18.75	76.94
Status at last FU	Alive without disease	28	56.0
	Alive with disease	10	20.0
	Dead	12	24.0
Time to last FU (Months)	Mean, SD	37.97	46.92
	Median, P75	20.75	56.13
	Range	0	273.75
5-year survival	N, rate (95% CI=13.1 - 38.2%)	12	24.0

Values are frequency, percentage; except if other specified.

SD: Standard deviation; P75: 75th centile; *4 out of the 12 patients had multisite metastasis; FU: follow up; 95% CI: 95% confidence interval

Table 2: Management and outcomes.

Survival and disease-free survival and their associated factors

Kaplan-Meier survival analysis showed mean (95% CI) survival time = 11.38 (4.95 – 17.80) years, and median (95% CI) survival time = 9.98 (6.57 – 13.39) years (Figure 1.a); while mean (95% CI) disease-free survival time was 8.64 (3.43 – 13.85) years and median (95% CI) disease-free survival time = 2.10 (0.00 – 6.34) years (Figure 1.b).

Patients who benefited from surgery achieved longer survival (mean survival=12.55 versus 4.26 years; p=0.043) and disease-free survival (10.0 versus 2.36 years; p=0.044) compared to those who had no surgery, respectively. Further, survival was significantly reduced in case of relapse (mean=5.17 versus 13.73 years; p=0.049) or metastasis (5.83 versus 18.52 years; p=0.045); while disease-free survival was reduced among known smokers (mean=5.14 versus 7.25 years; p=0.050) compared to non-smokers. Of note, although not statistically significant, patients with subglottic (mean=1.52 years) and glottis and subglottic (3.90 years) tumor localizations survival achieved the least survival, compared to supraglottic (8.40 years) and transglottic (6.94 years) ones, p=0.733 (Table 3, Figure 2).

Parameter	**Category**	**Survival (years)**			**Disease-free survival (years)**		
		Mean	**95% CI**	**Log-rank**	**Mean**	**95% CI**	**Log-rank**
Demographics							
Gender	Male	7.07	5.501; 8.63		5.19	3.57; 6.81	
	Female	22.81	22.81; 22.81	0.108	14.92	3.83; 26.02	0.352

Age at diagnosis (years)	≤53	13.52	5.01; 22.03		11.53	4.05; 19.01	
	>53	5.16	3.68; 6.64	0.061	3.39	1.95; 4.82	0.124
Nationality	Saudi	14.13	4.74; 23.52		11.07	3.50; 18.65	
	Non-Saudi	6.52	5.03; 8.00	0.330	4.31	2.68; 5.93	0.162
Risk factors							
Smoking (known)	No	11.36	4.73; 17.99		7.25	2.49; 12.02	
	Yes	5.14	3.89; 6.40	0.692	5.14	3.86; 6.42	0.050*
GERD (known)	No	13.91	7.70; 10.12		9.24	4.46; 14.02	
	Yes	8.09	5.85; 10.32	0.558	6.82	4.58; 9.06	0.108
Pathological factor							
Tumor site	Glottic	5.31	2.91; 7.71		3.75	1.52; 5.98	
	Supraglottic	8.40	5.95; 10.85		6.38	3.67; 0.09	
	Subglottic	1.52	1.29; 1.75		1.51	1.20; 1.82	
	Transglottic	6.94	5.48; 8.40		3.24	2.27; 4.20	
	Glottic & Subglottic	3.90	2.34; 5.46	0.733	1.85	0.25; 1.36	0.701
Histological type	Carcinoma in situ	-	-		-	-	
	SCC	-	-		-	-	
	Miscellaneous	-	-	-	-	-	0.362
Grade	Low	6.55	5.36; 7.74		4.54	3.09; 5.99	
	High	6.58	3.09; 10.07	0.236	5.63	2.17; 9.09	0.921
Management Factors							
Surgery	No	4.26	2.07; 6.45		2.36	0.71; 4.01	
	Yes	12.55	5.19; 19.91	0.043*	10.00	3.83; 16.16	0.044*
Chemotherapy	No	15.02	8.31; 21.72		12.78	6.01; 19.54	
	Yes	7.44	5.28; 9.59	0.646	5.07	3.20; 6.93	0.249
Radiotherapy	No	15.22	7.96; 22.48		13.52	8.06; 18.98	
	Yes	7.63	5.90; 9.35	0.918	4.84	2.78; 6.90	0.211
Overall management	None	-	-		1.06	0.13; 1.99	
	CT only	-	-		1.67	1.67; 1.67	
	Surgery only	-	-		16.08	8.43; 23.72	
	Surgery + RT	-	-		4.57	1.83; 7.30	
	RT + CT	-	-		2.66	0.28; 5.04	
	All three	-	-	0.002*	5.81	3.09; 8.54	0.273
Time to treatment	≤5 weeks	8.49	6.10; 10.88		6.58	4.16; 9.00	

	>5 week	13.46	7.46; 19.47	0.435	10.16	5.53; 14.78	0.349
Outcomes							
Relapse	No	13.73	5.30; 22.15		13.72	5.30; 22.15	
	Yes	5.17	3.32; 7.02	0.049*	0.66	0.32; 1.00	<0.001*
Metastasis	No	18.52	14.75; 22.29		14.80	10.55; 19.04	
	Yes	5.83	2.79; 8.86	0.045*	2.07	0.00; 4.19	<0.001*

Kaplan-Meier survival analysis exploring factors of survival (event=death) and disease-free survival (event= relapse or death). CI: confidence interval; GERD: Gastroesophageal reflux disease; SCC: squamous cell carcinoma; CT: chemotherapy; RT: radiotherapy; * statistically significant result ($p<0.05$).

Table 3: Factors of survival and disease-free survival in laryngeal cancer.

Predictors of survival and disease-free survival

The multivariate Cox regression models for survival and disease-free survival, including the respective significant factors in Kaplan-Meier analysis, showed no statistical significance (Table 4).

Parameter	**Category**	**Survival**			**Disease-free survival**		
		OR	**95%CI**	**p-value**	**Mean**	**95%CI**	**p-value**
Smoking (known)	No	NI			Ref		
	Yes				0.27	0.06; 1.17	0.080
Surgery	No	2.24	0.58; 8.75		2.35	0.94; 5.85	
	Yes	Ref		0.245	Ref		0.066
Relapse	No	Ref			NI		
	Yes	1.87	0.35; 9.93	0.464			
Metastasis	No	Ref			NI		
	Yes	1.75	0.35; 8.68	0.493			

Cox multivariate regression model analyzing independent factors of survival (event=death) and disease-free survival (event= relapse or death).
OR: Odds-ratio; CI: confidence interval; Ref: reference category for the regression model; NI; variable not included in the model
* Statistically significant result (p

Table 4: Predictors of survival and disease-free survival in laryngeal cancer.

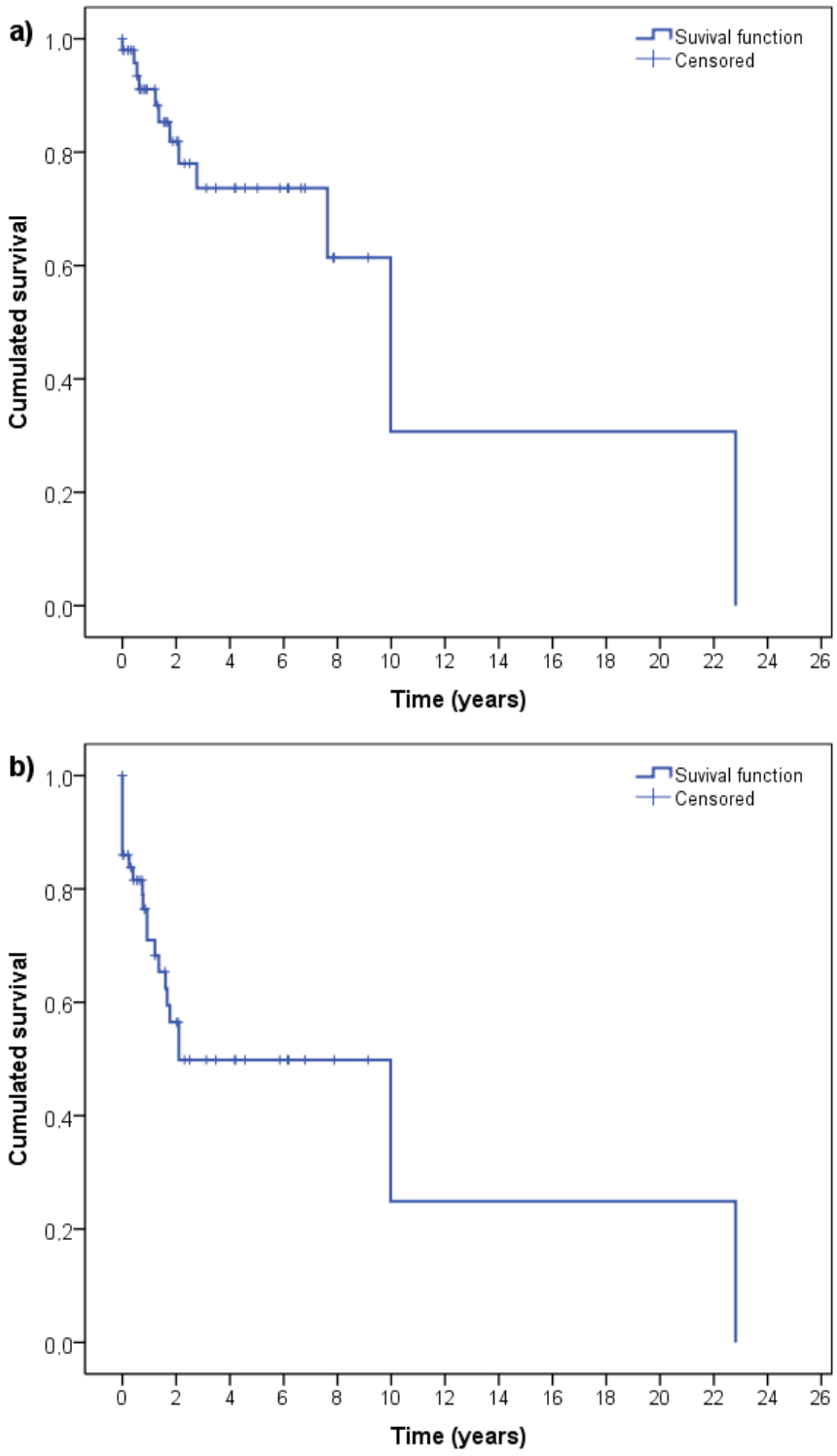

Figure 1: Kaplan Meier survival (a) and disease-free survival (b) in laryngeal cancer.

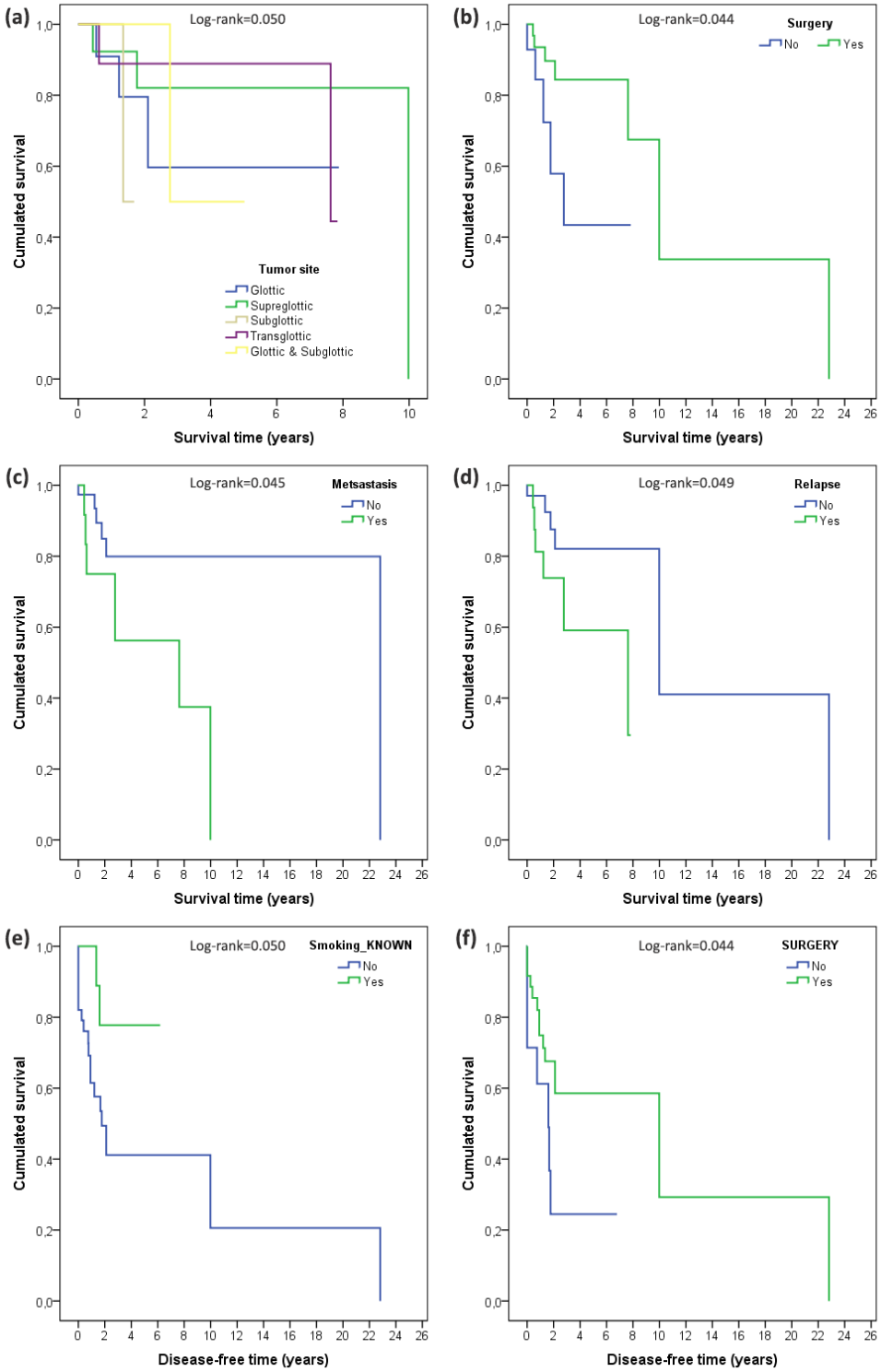

Figure 2: Most significant factors of survival (panels a-d) and disease-free survival (panels e, f).

Discussion

The primary challenge in LC treatment is not only to provide a curative treatment, but also to maximally preserve the function of the voice-producing organ. However, the variation and continually changing trends of LC treatments have led to discordant recommendations with different survival outcomes. Hoffman et al.[9] have early indicated a trend of reduced survival of patients in the mid-1990s attributable to changes in the management plans. To fill the gap of knowledge in survival variability, we assessed the prognostic outcomes of LC and their association with the clinical and therapeutic characteristics of the disease. Following the diagnosis, patients survived for a mean 11.38 years, while the mean disease-free-survival was 8.64 years. Surgical interventions provided significantly prolonged survival outcomes in terms of both overall survival and disease free survival as compared to non-surgical modalities. On the other hand, the overall survival was significantly shorter in patients who experienced a relapse or a metastasis, while smoking significantly reduced disease free survival.

Survival time was the primary indicator of patients' survival in our analysis. It is a robust indicator of the time for which a patient has benefited from an intervention. However, such a measure was not previously mentioned in detail in other investigations, a matter which was stressed in an early meta-analysis [10]. Alternatively, the five-year survival rate was utilized as a primary outcome in most studies. In our study, the five-year survival rate was 24%, which is lower than that reported in other countries. For example, based on patients' data during the period between 2009 and 2015 in the SEER database,[4] 60.3% of patient survived after 5 years. Similarly, large cohort-based European studies showed that 5-year overall survival was achieved by 66% patients, in a seven-year study conducted in Germany, [11] and 56.8% in a 15-year investigation in Norway [12].

Reduced survival in our cohort can be reasonably explained by several factors. First, 20% of the tumors were graded as "high", indicating that they were diagnosed lately. Indeed, early studies showed that a professional diagnostic delay of ≥12 months was a strong predictor of poor disease free survival in LC patients, and this effect mimics that of advanced stage [13]. Second, patients received treatment after a mean period of 6.81 months from the initial diagnosis. This might be associated with worsening of symptoms, tumor progression and/or metastasis. Actually, a therapeutic delay after diagnosis, whether due to logistic issues or patient-related factors, may influence the prognosis as indicated previously [14,15]. Therefore, it is recommended to have a moderate-to-high index of suspicion of LC diagnosis in patients with prolonged hoarseness until reaching a definite diagnosis. Additionally, primary care physicians are required to refer highly-suspected patients at the earliest. However, such strategy requires high awareness among both the healthcare professionals and the population. Third, the pathological data of a considerable proportion of patients, including histological grade, tumor stage, or tumor site were lacking. These patients (representing 10% to 24% of all patients) might have had atypical diagnostic and therapeutic pathways, which resulted in mismanagement and hence poorer survival outcomes. To overcome these deficits, a standardized specimen collection protocol is advised in local clinical settings. Finally, the interaction of other comorbidities with patient's survival was not considered in the analysis of our cohort owing to the lack of relevant data. This might also contribute to the observed poor survival.

On the other hand, regarding improvements in the survival outcomes after surgical interventions, data from literature were quite conflicting. Recent meta-analyses revealed better odds of overall survival and disease free survival in patients with early glottic cancers who underwent a TLM as compared to those receiving radiotherapy [16,17]. However, the two interventions were equally efficacious in terms of local LC control following an initial resection. Of note, early meta-analyses revealed contrasting outcomes, where there were no differences in overall survival and disease free survival between both modalities in T1 glottic cancer [18,19]. However, this may be attributed to the effect of the learning curve of surgeons to successfully perform TLM procedures [20]. Therefore, surgeons experience plays a significant role in improving the outcomes of glottic procedures, particularly for T2 and T3 tumors detected at the anterior laryngeal commissure [20]. However, the direct impact of treatment should be interpreted cautiously, since there may be a tendency towards treatment selection bias.

In the present study, poor patients' survival was associated with several factors, including metastasis, relapse, and smoking. Smoking is well-established as a significant risk factor of LC, and the risk further increases among heavy smokers as compared to ex- and intermediate smokers [1]. Moreover, Khat and shamma are two popular types of smokeless tobacco used in Saudi Arabia and Yemen, which were associated with frequent reports of oral, pharyngeal, and laryngeal cancers [21-23]. The association between smoking and LC could justify the unequal distribution of LC among males and females in the present study (86% vs. 14%, respectively). However, genetic susceptibility and individual's inherent sensitivity are prerequisite to induce a carcinogenic effect [1]. Collectively, despite the apparently low incidence of LC in Saudi Arabia, the high rates of smoking and the increasing trend of tobacco consumption locally [24] underscore the importance of further epidemiological investigations.

Other significant factors of survival in LC were reported in the literature. For example, site-specific differences in the survival were noted in a retrospective study of 1,616 patients with

a squamous cell laryngeal carcinoma [12]. More specifically, the favorable effects of surgery on survival were more significant in glottic locations of LC than in supraglottic ones. This contrasted with our findings that showed a trend of prolonged survival in patients with tumors localized at the supraglottic region as compared to glottic and subglottic LC, although this comparison did not reach the statistical significance. Further, positive N-status, older age at diagnosis, and advanced tumor (T3 and T4) were also associated with worse survival in some studies [11,12,25], while none of these factors was associated with overall survival or disease free survival in our study. Such inconsistency may be related to limited sample size in our cohort, in addition to eventual biases in therapeutic decisions due to discrepancy in the stage at diagnosis, or potential variations due to comorbidities that may impact survival.

Limitations

The major limitations of this study lie in the retrospective nature combined with the lack of important data in the patients' records, which did not allow evaluating the impact of other confounders that might have a great impact on patient outcomes, such as the associated comorbidities. The small sample size was another important limitation that probably induced high type II error, where a true null hypothesis (the existence of statistically significant effects) might be falsely rejected. Although these limitations compromise the generalizability of the findings, our study is the first retrospective investigation in Saudi Arabia concerning survival outcomes in LC patients. We provided preliminary data about the clinical characteristics of the disease at the local level, as well as an insight into the efficacy of the most common management approaches. More importantly, these data may be used in local meta-analysis to provide more accurate picture on the clinical and pathological factors of survival in LC in the national level.

Conclusion

The present study showed that LC patients had low survival rates as compared to other regions. Cancer relapse, metastasis, and smoking were associated with worse survival, while a primary surgical intervention was associated with better survival profiles. Improving the diagnostic efficacy through accelerating patient's referral and increasing the level of index of suspicions for patients with prolonged hoarseness are some of the aspects of patient care that should be adjusted locally. It is imperative to promote the therapeutic efficacy via improving surgeons' expertise, implementing unified intervention policies, and setting clear and appropriate disease classification. There is a need to conduct future prospective, large cohort-based studies at the national level, which employ an in-depth analysis of the co-effects of other morbidities, smoking, and other pathological data on patient survival.

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