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# Radio clinical and Anatomopathological Correlation in Larynx Cancer

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# Summary

Objective: To evaluate the reliability of endoscopy and CT scanning in determining the extent of disease at several laryngeal levels.

Patients and Methods: A retrospective study comparing endoscopic and CT findings with histopathology in 100 cases of laryngeal carcinoma.

Results: Computed tomography exhibited high sensitivity to determine the spread of the tumor to the pre-epiglottic space (84%), glottis and the subglottis regions (71%, 74%); low sensitivity for studying laryngeal cartilages (51%) and extralaryngeal tissues (59%). The specificity of the scanner is better in the assessment of the invasion of the thyroid cartilage (83%) and epiglottis (88%) and the extension to the pre-laryngeal soft tissue (82%) while endoscopy is better in terms of specificity as to the piriform sinus invasion of (81%).

Conclusion: The diagnostic value of CT and endoscopy is 76%.

**Keywords:** Correlation of Data, Pathology, X-Ray Computed Tomography, Larynx, Neoplasms

# Introduction

Laryngeal carcinomas account for about 2.4% of all malignant tumors and whose squamous cell carcinoma is the most frequent histological type (95%) [1].

Direct laryngoscopy and biopsy are the gold standard

for the diagnosis of laryngeal cancer, but multiple imaging modalities exist and some are under development including spiral computed tomography (CT) and more recently multi-detector computed tomography which allowed neoplasm identification at an early stage [2-3].

The endoscopy-computed tomography pair allows exploration of the anatomic zones (the para-glottic space, the subglottis, the cartilages and the hyothyro-epiglottic space...) whose impact modifies the therapeutic management (partial laryngectomy, total laryngectomy or even a surgical contraindication).

The aim of this study is to compare the reliability of CT and endoscopy in evaluating the initial loco regional extension of laryngeal cancer by referring to histologic data.

# Methods

This is a retrospective study of patients operated for squamous cell carcinoma of the larynx by total laryngectomy with bilateral lymph node dissection between January 2013 and June 2018 at ENT department of the 20th August Hospital of Ibn Rochd University Hospital.

All patients with a delay of more than one month between endoscopy and CT and between one of these two examinations and the surgical procedure were excluded.

Endoscopy with general anesthesia and 32 slice multidetector computed tomography before and after contrast material injection (CM) were performed in all patients. CT images have all been reviewed by an otolaryngologist and a radiologist. Direct suspension laryngoscopy with general anesthesia allowed to specify the macroscopic appearance of the tumor, its location and especially its extension in addition to performing biopsy samples.

The CT allowed to study the deep spaces of the larynx (paraglottic space and pre epiglottic space), prelaryngeal soft tissues, cervical lymph nodes, the cartilages (thyroid, cricoid and arythenoid), sub glottis and the cervical lymph nodes.

First, we compared the endoscopic aspect and the CT of the different areas of the larynx : vocal cords, anterior commissure, vestibular folds, laryngeal ventricles, subglottis, preform sinuses, hyo-thyro-epiglottic space, laryngeal cartilages as well as prelaryngeal soft tissues and cervical lymph nodes. All patients were classified according to TNM staging system of the AJCC Cancer Staging Manual, Eight Edition (2017). The tumor stage extension assessment including CT and endoscopy was compared to the tumor stage of the histopathological examination.

The results were ranked in terms of sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for each anatomical location.

### Results

100 patients were involved in this study. The average age in our series is 62 years with a standard deviation of 10.19 (97 males and 3 females). 91 patients were current of former smokers and 2 patients were active or former users of alcohol.

Dysphonia was the main symptom (100% of patients). 50 patients had dyspnea and 1 patient had dysphagia.

At the level of the glottis, we found that both endoscopy and CT had a good sensitivity of 92.20% and 93.61% respectively for assessment of vocal cord invasion. The CT is better to assess anterior commissure extension (Figures 1 & 2) in contrast with the assessment of vestibular folds and the laryngeal ventricles extension in which the endoscopy is more sensitive (89.39% vs. 78.57%). However, it should be noted that the examination of the vocal cords was limited in endoscopy by the presence of supraglottic tumor in 19 patients.

The CT has a better sensitivity to assess the subglottis extension than endoscopy (67.12% vs. 54.28%).



**Figure 1.** Endoscopic appearance of a budding tumor taking the anterior 1/3 of the left vocal cord, the anterior commissure and arriving at the right vocal cord contact.



**Figure 2.** CT of the larynx in axial section passing through the 2 arytenoids:Tumor taking all left vocal cord (arrow) with invasion of the anterior commissure (star).



**Figure 3.** CT of the larynx in axial sections passing through the epiglottismoderate invasion of the pre-epiglottic space (star).

However, the endoscopy has a better specificity and a better PPV (100%). Both examinations have a low NPV. CT also has a good sensitivity for the assessment of the pre epiglottic space (Figure 3) and for paraglottic space (98.83%) in contrast with low specificity and low NPV. Regarding the cartilages, the CT showed an excellent sensitivity for the assessment of arytenoid invasion (100%), a good sensitivity for epiglottis (65%) but a low sensitivity for the thyroid and cricoid cartilages. However, the CT had eliminated the involvement of the cricoid and arytenoid cartilages with a NPV of 90.90% and 100% respectively. For the study of the preform sinus invasion, the CT had a better sensitivity (54%) contrasting with a better specificity for the endoscopy (88.23%). Therefore, the two examination showed low NPV.The CT had a low sensitivity (39.58%) and a good specificity (82.69%) for the assessment of the extra laryngeal soft tissue invasion.

Among 30 cases when lymph node metastasis was histologically proven, the CT allowed them to be suspected in half of the cases. However, the CT showed good specificity and NPV regarding this matter.

This study showed that CT had a better sensitivity for exploration of the vocal cords (93.61%), the anterior commissure (87.20%), the paraglottic space (98.83%), the pre epiglottic space (86.66%), the subglottis (67.12%), and laryngeal (58.44% to 100%), whereas endoscopy showed a better sensitivity in exploration of vestibular folds (85.71%), laryngeal ventricles (89.39%), vocal cords (92.20%) and anterior commissure (80%).

### Discussion

The knowledge and practice of endoscopic anatomy of the larynx has considerably improved with the progress of endoscopy and imaging techniques. In contrast with descriptive anatomy and data provided by imaging, endoscopy allows to study the pharyngolaryngeal cavity in a surface view.

Endoscopy is an essential examination for the positive diagnosis and assessment of laryngeal tumors as well as any other localization of the upper aero-digestive tract [3]. It particularly assesses the tumor extension in the subglottis, the anterior commissure, the epiglottis and the laryngeal ventricle. Palpation of the lesions allows also to judge the importance of tumor infiltration [4]. The histopathological examination makes it possible to confirm the diagnosis of cancer. Also, performing biopsies specifically in apparently healthy areas and considered as hinges for conservative laryngeal surgery is essential. In our study, endoscopic examination allowed in 73.19% of cases to correctly assess the local extension of all tumors. It has almost the same sensitivity as CT for the study of the glottic level (vocal cords) and better explores the supraglottic level (lanryngeal ventricles and vestibular folds), but it remains insufficient for the assessment of the subglottic extension, particularly because of the obstructive character of some tumors. Our results are consistent with the Hammami study, which showed that endoscopic examination in 77% of cases correctly assessed the local extension of all tumors [5]. The same study showed that endoscopy demonstrates its high reliability for small tumors, classified T1 and T2.

The limits of this examination are the need for a general anesthesia and the impossibility of appreciating the active laryngeal mobility, the impossibility of exploration of anterior commissure and the subglottis if it is a large glottic or supraglottic obstructive tumor. Also, endoscopy remains an examination that allows the study of extension only at the surface. Its sensitivity is zero in the exploration of pre-epiglottic space, laryngeal cartilages and prelaryngeal soft tissues.

The contribution of the multi detector CT has revolutionized the study of the larynx. It is currently the first-line examination for laryngeal morphological study given its diagnostic contribution, availability and affordability. In addition, the quality of acquisitions has benefited greatly from technological advances and the widespread use of multi-detector CT. These allow the acquisition of large volumes of tissues, used in current practice in the locoregional extension of laryngeal cancer [6]. It is an integral part of "staging" with a crucial role in the therapeutic decision and the follow up [7]. The CT assesses tumor extension at different laryngeal stages, pararyngeal fat spaces, vascular spaces, oropharynx, hypopharynx and trachea. Kraas showed that preoperative CT assessment was a predictor of locoregional control in laryngeal cancers [8].

One of the main difficulties remaining to determine if there is an invasion of the cartilaginous framework of the larynx which is the seat of heterogeneous physiological calcifications. In our series, in 70.41% of cases, CT was able to correctly assess the locoregional extension of all tumors, a result consistent with the Hammami study, which reports CT efficiency for exploration of larynx as 75% [5]. The interest of the CT compared to the endoscopy is in the study of the tumor extension in depth (fat spaces, cartilages) and it appears more reliable in the study of the invasion of anterior commissure and the glottis. It reveals the lesion of the key areas of the therapeutic decision. In contrast to endoscopy, the specificity and especially the sensitivity of the CT increases when the T stage increases especially in the study of the glotto-subglottic stages (sensitivity = 35% for T1T2 versus 66% for T3T4). On the other hand, the CT of the pre-epiglottic space and the aryepiglottic folds is much better for small T1T2 tumors [5].

In this study, we will continue this discussion by analyzing the different laryngeal structures studied:

In the supraglottic level, excellent endoscopic specificity has been found for the study of the invasion of ary-epiglottic folds (97%), in a contrast with a poor sensitivity (38%) according to the literature [5]. While the hyo-thyro-epiglottic space that can not be clinically evaluated by endoscopy is well studied on a median sagittal CT, with a sensitivity between 66 to 95% according to the literature, comparable to that found in our series [5,9]. The endoscopic appearance of the ventricular bands is usually symmetrical. Asymmetry must always draw attention to a deep tumor pathology, our study has shown that endoscopy is the best examination for the exploration of ventricular bands with sensitivity at 85.71%, as well as the series published by Hammami and Hassouny reported comparable rates with sensitivity of 75% and 78% respectively [5,9]. The sensitivity of endoscopy for laryngeal ventricle exploration in our series was 89.39% better than that of CT (78.57%), with variable data in the literature; thus Hassouny, found an average sensitivity of 72%, Hammami found an average sensitivity of the endoscopy to 69% this percentage was variable depending on the tumor extension level.

Regarding the glottal level, the use of 70° optics is particularly suitable for the examination of the lower surface of the vocal cords especially the anterior commissure. These two regions are very important to assess the extent of glottic cancer. Our study concluded that CT sensitivity is close to that of endoscopy for vocal cords exploration (93.61%). The results of the literature are discordant, some authors affirm a much better sensitivity of the endoscopic examination than that of the scanner (95.4% versus 36.3%) [10], while others pretend a better sensitivity of CT scan (78 to 88%) [11], but most of them agree that endoscopy is very reliable for the examination of the vocal cord [12]. On the other hand, the CT showed an excellent sensitivity of 98.83% for the exploration of the paraglottic space, in contrast with an average specificity of 50%. Similar results are reported in the study of Mighri which reports a sensitivity of 94.4% [13]. This area has a major oncological importance because it has direct implications on the classification of the tumor and therefore its therapeutic management [14] (Table 1).

Endoscopic examination of the subglottic level may

Examination	Endoscopy				Computed tomography			
Region	Sensibility	Specificity	PPV	NPV	Sensibility	Specificity	PPV	NPV
	%	%	%	%	%	%	%	%
Vocal cords	92,20	50	97,26	25	93,61	33,33	95,65	25
Anterior commissure	80	46,15	69,13	31,57	87,20	42,58	90,36	35,29
Laryngeal ventricles	89,39	16,66	70,23	41,66	78,57	46,66	77,46	51,72
Vestibular bands	85,71	36,36	82,5	42,10	81,42	46,66	78,08	51,85
Infraglotticlevel	54,28	100	100	48,38	67,12	59,25	81,66	40
Hyotyroepiglotticspace	-	-	-	-	86,66	37,50	83,87	42,85
Paraglottic Space	-	-	-	-	98,83	50	94,64	33,33
Epiglottis	60	88,75	57,14	89,87	65	80	44,82	90,14
Thyroid catilage	-	-	-	-	58,44	86,95	93,75	38,46
Cricoid cartilage	-	-	-	-	66,66	74,07	36,36	90,90
Arythenoid cartilages	-	-	-	-	100	55,55	7,69	100
Piriform sinus	26,53	88,23	22,41	14,28	54	50	51,92	22,41
Prelaryngeal soft tissues	-	_	-	-	39,58	82,69	67,85	59,72
Lymphadenopathies	-	-	-	-	50	87,14	62,50	80,26

**Table 1.** Correlation between endoscopy and computed tomography for each area of the larynx.

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be insufficient to correctly examine this region, particularly in the case of obstructive glottic and supra-glottal tumors preventing the progression of the optics towards the subglottis. This explains the valuable contribution of the CT for the study of this region which, with involvement of cricoid cartilage, is synonymous with total laryngectomy. In our series, CT was more sensitive than endoscopy for the study of subglottic lesions (67.12% versus 54.28%), but it is less specific (59.25% versus 100%). These figures remain low compared to other series. For Hammami, the sensitivity of the CT scan for subglottic lesions (74%), but it is less specific (30%) [5]. Hassouny reports a good sensitivity of 78% [9].

The study of cartilage extension has an importance in the pre-therapeutic assessment of laryngeal cancers. In our series, the average sensitivity of the CT in the detection of a cartilaginous invasion was 72% with a good specificity of 74%. This is concordant with the results of the literature [10-16]. This sensitivity is higher for arytenoids (100%) than for cricoid (66.66%), epiglottic (65%) and thyroid cartilages (58.44%). The sensitivity of CT in our series for the study of lymph node extension did not exceed 50%, while the specificity was 87.14%. These results are discordant with the literature which reports excellent sensitivity of CT in the detection of ganglionic extension at 90% and specificity at 73% [17].

The extra-laryngeal extension is an important element brought by the CT but its sensitivity does not exceed 40% in our series, whereas its specificity is higher than 80%. These results join those of the study of Hammami which reports low sensitivity at 46% contrasting with excellent specificity at 90 % [5]. Hassouny notes an average sensitivity (51%) with a better specificity (90%) in the assessment of the pre-laryngeal soft tissue extension [9]. As the CT allowed to better explore the piriform sinuses with a sensitivity to 54% against 26,53% for the endoscopy, however the endoscopy was more specific for the study of this region (88,23% against 50%), joining the literature which reports a low sensitivity of 50% and an excellent specificity of 97% [5].

### Conclusion

The association CT and endoscopy are mandatory and especially complementary for a precise study of the locoregional extension of laryngeal cancers. CT and endoscopy in combination have a diagnostic value of 76%. Recently with the improvement of the conditions of realization of the endoscopy and the contribution of the CT, their performances will certainly increase.

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