SCIENTIFIC RESEARCH

ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN ASSESSMENT OF LARYNGEAL CANCER AT HUE CENTRAL HOSPITAL: SHARING EXPERIENCES FROM A SINGLE CENTER FROM 31 CASES

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SUMMARY

Background: The role of multidetector computed tomography (MDCT) in diagnosing and staging 31 patients with laryngeal carcinoma.

Methods: Patients with laryngeal carcinoma were diagnosed at Hue central hospital from February 2019 to July 2020. Patients were clinically diagnosed patients of laryngeal masses, were first evaluated under indirect laryngoscopy, and then sent for Computed Tomography (CT). Postimaging biopsy was undertaken via direct laryngoscopy. Imaging features of the tumor such as site, level of invasion and staging of tumor were analyzed.

Results: The mean age was 61±11 with 90% of patients are male. The risk of laryngeal cancer for those patients who were active smokers (93.5%), and alcohol consumers (67.7%). The most common symptom was hoarseness (93.5%). In CT image, more than half of the cancers were carcinoma of the glottis (29%) and two regions supraglottis and glottis (22,6%), while the less common cancers were the subglottic (3.2%) and all three regions (9.7%) carcinoma, especially true vocal cord (67,7%) is the most common site starting carcinoma. The percentage of tumors spreading to paraglottic space and pre-epiglottic space was 50% and 30.6% respectively. The most common stage of laryngeal cancer in CT was T3 stage (35,5%). There is a weak agreement (Kappa=0.518) in staging in laryngeal cancer in CT compared to laryngoscopy.

Conclusion: MDCT is better in staging laryngeal cancer in T3, T4 stages as compared to laryngoscopy.

Key words: *Laryngeal carcinoma, MDCT, CT, endoscopy*

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INTRODUCTION

Laryngeal cancer is one of the most common tumors of the respiratory tract [1]. According to the National Center for Health Statistics 2018 in the United States, laryngeal cancer ranks 2nd in the total number of respiratory cancers [2]. According to GLOBOCAN 2018 data, laryngeal cancer has an incidence rate of 177,422 cases and a mortality rate of 94,771 cases [3].

Imaging plays an important complementary role to clinical examination and endoscopic biopsy in the evaluation of laryngeal cancers. Integration of radiological findings with endoscopic evaluation greatly improves the pretherapeutic staging accuracy of laryngeal cancers, and significantly impacts the choice of management strategies in these patients [4].

Computed tomography findings of tumor extension in the extra-laryngeal soft tissues and erosions of arytenoid, cricoid, and thyroid cartilages' inner cortex show a strong correlation with the histological examination in predicting neoplastic infiltrations. CT showed high diagnostic accuracy in the preoperative assessment of laryngeal cartilages infiltrations in patients with primary and post-radio-chemotherapy recurrent advanced-stage laryngeal carcinoma. Therefore, CT examination for laryngeal carcinoma staging should be preferred over Magnetic Resonance Imaging in patients with significant obstructive respiratory distress to reduce the waiting time for starting treatment [5].

Currently, in the world, many imaging techniques are used to evaluate the clinical and stage of head and neck cancer patients in general and larynx in particular, especially multidetector computed tomography and MRI. However, not all health facilities are equipped with MRI machines. Nowadays, MDCT is almost common in most health facilities. Therefore, we carry out this study to apply MDCT in clinical practice to accurately diagnose and stage laryngeal cancer, helping to choose the right treatment method for the patient, avoiding recurrence later. In addition, as per the available literature, even though endoscopic examination and CT both can be used to diagnose and stage laryngeal cancer one is better than the other in certain perspectives. In this study, we have compared the efficacy of endoscopic examination and CT of the larynx in the diagnosis and staging of laryngeal carcinoma.

MATERIALS AND METHODS

Patients with laryngeal carcinoma were diagnosed at Hue central hospital from February 2019 to July 2020. Imaging information is stored in the original medical record and the Pacs system. The study was approved by the researchs ethics committees of Hue Medical University.

The inclusion criterion was the patients who were histologically confirmed diagnosis of primary laryngeal carcinoma.

The exclusion criteria were the patients who got any prior or current treatment modality, hypopharyngeal cancer or hypopharyngeal cancer spreading to larynx, contraindications of CT.

Patients were clinically diagnosed patients of laryngeal masses, were first evaluated under indirect laryngoscopy and then sent for Computed Tomography (CT). Biopsy was undertaken via direct laryngoscopy. Imaging features of the tumor such as site, level of invasion and staging of tumor were analyzed.

SCAN PROTOCOL

All CT exams were performed with a 32-detector row helical CT scanner (GE, USA) with the following parameters: tube voltage 110 kV, pixel size 0.625 mm, field of view 200 mm, both thickness and reconstruction intervals 1 mm, current×exposure time 85 mAs, rotation time 1s, beam collimation 128×0.6 mm, pitch 1 mm, and reconstruction kernel 131 s/3. Patients underwent unenhanced and contrast-enhanced scans after 60 s from intravenous contrast media injection. A 1-1.5ml/Kg dose of iopromide (Ultravist 300mgI/ml) was administered with a power injector at a flow rate of 3-4 mL/s, followed by a 40-ml bolus of saline solution. The field of view was extended from the skull base to the thoracic inlet. Post-processing, 1mm-thick sections were obtained on axial, sagittal, and coronal planes oriented on the glottic plane.

RESULTS

There were 31 patients diagnosised of primary laryngeal carcinoma at Hue central hospital from February 2019 to July 2020. The mean age is 61 ± 11 with 90.3% male, 83.9% of patients aged over 51. The risk of

laryngeal cancer for those patients who were active smokers (93.5%), and alcohol consumers (67.7%). The most common symptom was hoarseness (93.5%).

Table 1. Region distribution of Carcinoma in CT (n=31)

Region	n	*Percentage*
No finding detected	4	*12,9*
Glottis	9	*29,0*
Supraglottis and glottis	7	*22,6*
Supraglottis	4	*12,9*
Glottis and subglottis	3	*9,7*
Supraglottis, glottis and subglottis	3	*9,7*
Subglottis	1	*3,2*

CT images revealed carcinoma distributed mainly in the glottis and two regions supraglottis and lottis, accounting for 29% and 22.6%, respectively. Tumors in all 3 regions of the larynx accounted for 9.7%.

Table 2. Structure invasion of carcinoma in CT (n=31)

Structure	Number	Percentage
Paraglottic space	13	*50,0*
Pre epiglottic space	9	*34,6*
Thyroid cartilage	2	*7,7*
The infrahyoid muscles	2	*7,7*

The paraglottic space (50%) and the pre epiglottic space (34.6%) were the most common sites of invasion. Thyroid cartilage and infrahyoid muscles were uncommon with a rate of 7.7%.

Table 3. T staging of carcinoma by CT (n=31)

T Stage	Number	*Percentage*
T0	4	*12,9*
T1	6	*19,4*
T2	8	*25,8*
T3	11	*35,5*
T4	2	*6,5*

T3 was the most common stage in our study (35.5%). T2 accounted for 25.8%. T1 accounted for 19.4%. The percentage of T4 was 6.5% and 4 patients (12.9%) did not detect any lesions on CT.

Table 4. Comparison of the stage (T) on CT versus endoscopy (n=31)

T staging T0		MDCT					
		T1	T2	T3	T4	n	
Endoscopy	T1	3	6	0	0	0	9
	T2	1	0	8	5	0	14
	T3	0	0	0	6	2	8
	n	4	6	8	11	2	31
Kappa = 0,518							

According to our study, there were 4 tumors (12.9%) at T0 stage on CT scan which were upgraded to T1 and T2 stage on endoscopy, in addition, there were 5 tumors (16.7%) in T2 stage on endoscopic upgraded to T3 on CT and 2 tumors (6.5%) in stage T3 on endoscopic upgraded to T4 on CT.

The agreement of tumor on staging (T) between CT and endoscopic examination was weak (Kappa=0.518).

DISCUSSION

In our study, 31 patients were recruited. Middle and elderly patients still accounted for the majority (83.9%) with a mean age of 61±11, similar to the results of the Noppadol study (62 ± 10) [6] or Hazem M (58 ± 11) [7]. Most patients were male (90,3%), similar to the results of Tanadech Dechaphunkul (92,3%) [8] or Markou K. (98.6%) [9]. There was a big gender difference in our study because the percentage of men who smoke and drink alcohol was much higher than women, that resulting in a high risk of laryngeal cancer in men. They were the main risk factors in our study with 93.5% patients smoking and 67.7% patients drinking alcohol, similar to the study of many authors, including Tanadech [8] or Wang [10] with the rate of active smokers and alcohol consumers were 83.2%, 58,4% or 75%, 55% respectively.

In our study, the tumor was mainly distributed in the glottis with the rate of 29%, followed by the two regions supraglottis and the glottis accounting for 22.6%. 4

cases (12.9%) were not detected any finding by CT. This result is quite similar to Aniruddha Sarkar with the most common site of disease was glottis (42.4%) [11], followed by transglottis involvement in 36.3%. But unlike Kashyap's study, the tumors were mainly distributed in the two regions supraglottis and glottis or all three regions with the rate of 70.8% and 16.7%, respectively [12]. This result showed that our study focuses on tumors at an early stage, which has not yet invaded other larynx's regions. Besides, 4 cases were not detected by CT, possibly because the size of these tumors is small, tumor cells are confined to the mucosa and did not invade deeply, so the CT scan could not be detected.

In our study, the majority of tumors tended to invade the paraglottic space and then the pre-epiglottis space with the rate of 50% and 34.6%, respectively, with 2 cases accounting for 11. 1% invades thyroid cartilage and infrahyoid muscles. This rate is also quite similar to Louay El-Sharkawy 's study that showed the invasion into the paraglottic space accounted for 63.3% and the pre-epiglottis space was 23.3% [13]. This is because the spread of tumor is facilitated through open areas of loose connective tissue; areas composed of loose collagen and reticulin fibers are easily invaded by tumors such as paraglottic space or pre-epiglottis space, while laryngeal cartilages are relatively resistant to tumor invasion often demonstrating extensive tumor spread along and around the laryngeal cartilage surfaces before the invasion.

T staging	Our study (%)	Louay El-Sharkawy [13]	Kashyap [12]	Aniruddha Sarkar [11]
T0	12,9	6.7	0	0
T1	19,4	13.3	12,5	9
T2	25,8	10	12,5	18.2
T3	35,5	46.7	50,0	30.3
T4	6,5	23.3	25,0	42.4
n	31	30	24	33

Compared with some studies, our results are quite similar when the T3 stage accounts for the highest percentage, however, in our study, the cancer was mainly on stage T2, T3, while the remaining studies focus on stage T3, T4. This may be due to the small tumor size, our patients distributed in an early stage when the tumor has not invaded widely.

On comparing the site diagnosis of laryngeal carcinoma on endoscopy and CT, 4 patients (12.9%) could not identify lesions on CT compared with endoscopy because the tumors were changed in the mucosa. Similarly, there was 1 case of tumor in the glottis spreading to the supraglottis on endoscopy, but the CT was not detected. There were 2 cases in which the tumor grew in many regions of the larynx that could not be detected on endoscopy because the bulky tumor and even normal cords could hide the subglottic area, which makes it difficult for endoscopic examination to determine whether the tumor had invaded the subglottis.

On comparing the stage of laryngeal carcinoma on endoscopy and CT, CT scan is a poor tool in identifying early mucosal changes like mucosal edema and mucosal thickening whereas they can be picked up with relative ease by endoscopic examination if present (4 tumors (12.9%) at T0 stage on CT scan were upgraded to T1 and T2 stage on endoscopy)

Accurate assessment of preepiglottic and paraglottic is mandatory for a correct staging of supraglottic tumors' progress into T3 tumors if the preepiglottic space and/ or the paraglottic space are involved. The importance of the paraglottic space lies in the accurate staging of transglottic tumors. Endoscopy could give an idea about paraglottic space invasion through assessment of the mobility of the vocal cords which is difficult in bulky supraglottic tumors (5 tumors (16.7%) in T2 stage on endoscopic were upgraded to T3 on CT).

T4 tumors which invade through the outer cortex of thyroid cartilage, cricoid cartilage and tissues beyond

the larynx are underestimated on endoscopy (2 tumors (6.5%) in stage T3 on endoscopic upgraded to T4 on CT). Here CT is effective in detecting the laryngeal cartilage invasion.

There was a weak agreement of tumor staging ability (T) between CT and endoscopic examination (Kappa=0.518). The combination of endoscopy and CT resulted in significantly improved staging accuracy (80%).

LIMITATION

Our study primarily focuses to compare the characteristics and values of computed tomography and endoscopic examination in laryngeal cancer, thus it is limited in that it does not compare surgery, which is the gold standard of invasive assessment and staging of tumors. Therefore, we will continue to carry out this study in the future.

CONCLUSION

The accurate diagnosis and staging of laryngeal tumors are essential for appropriate treatment planning. CT assessment for the subglottic involvement is more accurate than endoscopy, especially the bulky tumor. MDCT is superior to laryngoscopy in the evaluation of T3 and T4 tumors. Laryngoscopy is better than MDCT in the evaluation of T1 and T2 lesions. Combined assessment of tumor by endoscopy and CT of larynx plays a vital role in better diagnosis and management of Laryngeal cancers.

Compliance with ethical standards

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Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/ or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent These forms were obtained from the patients included in the study.

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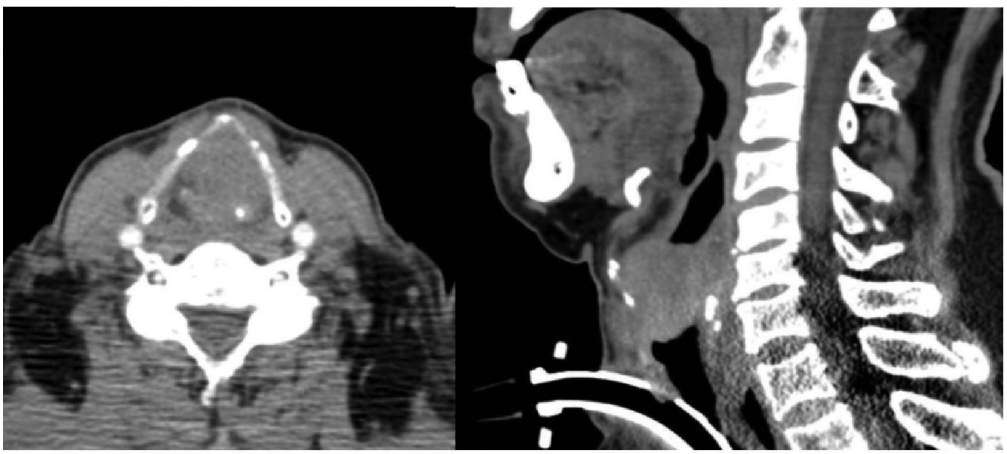

Figure 1. Male 83-year-old patient. Computed tomography in axial and sagittal plane showed the large tumor extended in all 3 regions of the larynx. Pathology showed squamous cell carcinoma

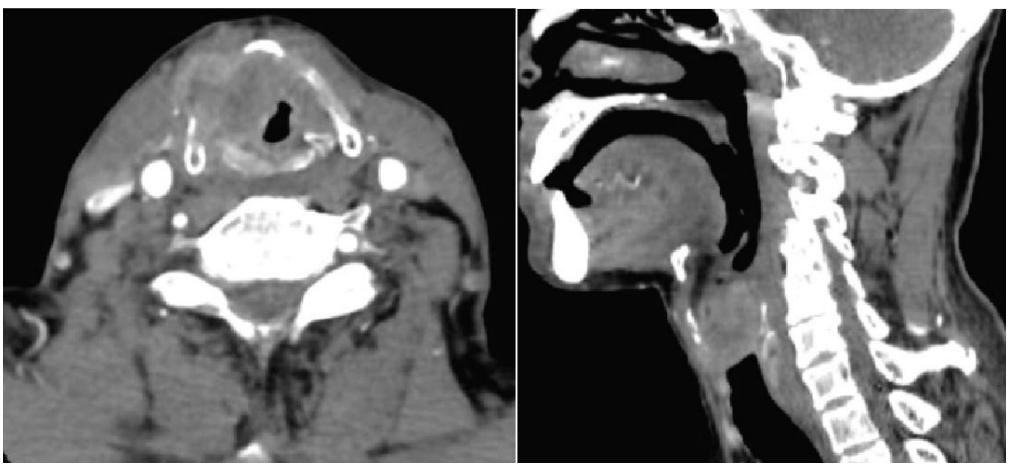

Figure 2. Male 72-year-old patient. Computed tomography in axial and sagittal plane showed the large tumor in the glottis invading the paraglottic space, thyroid cartilage and the infrahyoid muscles. Pathology showed squamous cell carcinoma

Figure 3. Male 64-year-old patient. Computed tomography in axial showed the tumor in the right vocal cord invaded the right paraglottic space. Pathology showed squamous cell carcinoma.

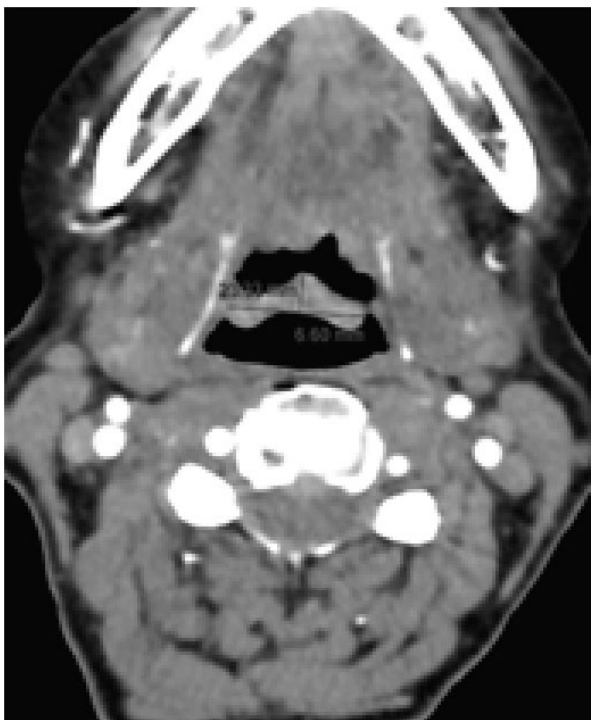

Figure 4. Female 74-year-old patient. Computed tomography in axial shows tumor in the epiglottis. Pathology shows squamous cell carcinoma.

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