

Role of Contrast Enhanced Computed Tomography (CECT) in Evaluation of Laryngeal Mass with Histopathological Correlation

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Abstract: Laryngeal masses represent a significant pathology, with malignancy being the most critical concern in this context. Among these malignancies, Squamous Cell Carcinoma (SCC) of the larynx is the most prevalent, accounting for approximately 25% of all head and neck cancers. This research contributes to understanding the diagnostic accuracy of CECT in laryngeal cancer staging and its implications for treatment planning, reinforcing the need for an integrated approach combining clinical assessment and advanced imaging techniques. **Purpose of Study:** The document highlights the importance of CECT as a diagnostic tool that provides detailed insights into tumor size, extent of invasion, and involvement of surrounding structures. It discusses how CECT complements clinical examinations by offering a more comprehensive view of deep tissue involvement, which is often underestimated during clinical assessments. The study aims to correlate CECT findings with histopathological results to enhance diagnostic accuracy and improve treatment planning.

Keywords: Laryngeal Cancer, Squamous Cell Carcinoma (SCC), Contrast Enhanced Computed Tomography (CECT), Laryngeal Imaging, Vocal Nodule, Vocal Cords, Smoking

1. Introduction

Laryngeal cancer which is a type of head and neck cancer is predominantly squamous cell carcinoma (SCC) and accounts for about 3% of all cancer cases globally. Risk factors include tobacco use, alcohol consumption, human papillomavirus (HPV) infection, and exposure to occupational hazards like asbestos. Diagnosis is confirmed through imaging, biopsy, and endoscopy. A contrast - enhanced CT scan (CECT) plays a crucial role in diagnosing & staging laryngeal carcinoma which in turn helps guide treatment decisions by providing detailed images of the tumor location, its size, and its extent of spread, particularly to the surrounding cartilages and regional lymph nodes.

2. Limitations

- The study's relatively small sample size and single - center design may limit the generalizability of understanding the diagnostic accuracy of CECT in laryngeal cancer staging
- We did not include pediatric patients in our study due to the limited availability of pediatric inpatient and outpatient data.
- Future studies with larger patient cohorts and diverse geographical representation are needed to validate and

enhance the diagnostic performance of CECT in evaluation of Laryngeal masses.

3. Case Report

A 69 - year - old man presented to the Emergency department of J. L. N. Hospital with respiratory distress. He was noted to have marked stridor that prompted urgent airway assessment and management.

History taking revealed that patient is a chronic smoker with 50 pack years smoking history and alcoholic and had complains of hoarseness of voice for 8 months progressive in course. Following which he had mild shortness of breath and Dysphagia for around 2 months and the shortness of breath worsened for past 5 days.

On examination patient had inspiratory and expiratory stridor in seated position under nasal prong oxygen. The patient was successfully intubated and was admitted in ENT department where Flexible nasopharyngolaryngoscopy was performed and demonstrated a narrow airway at vocal cord region.

From where he was sent for C. T. scan and Histopathological examination and the CT Findings are shown below.

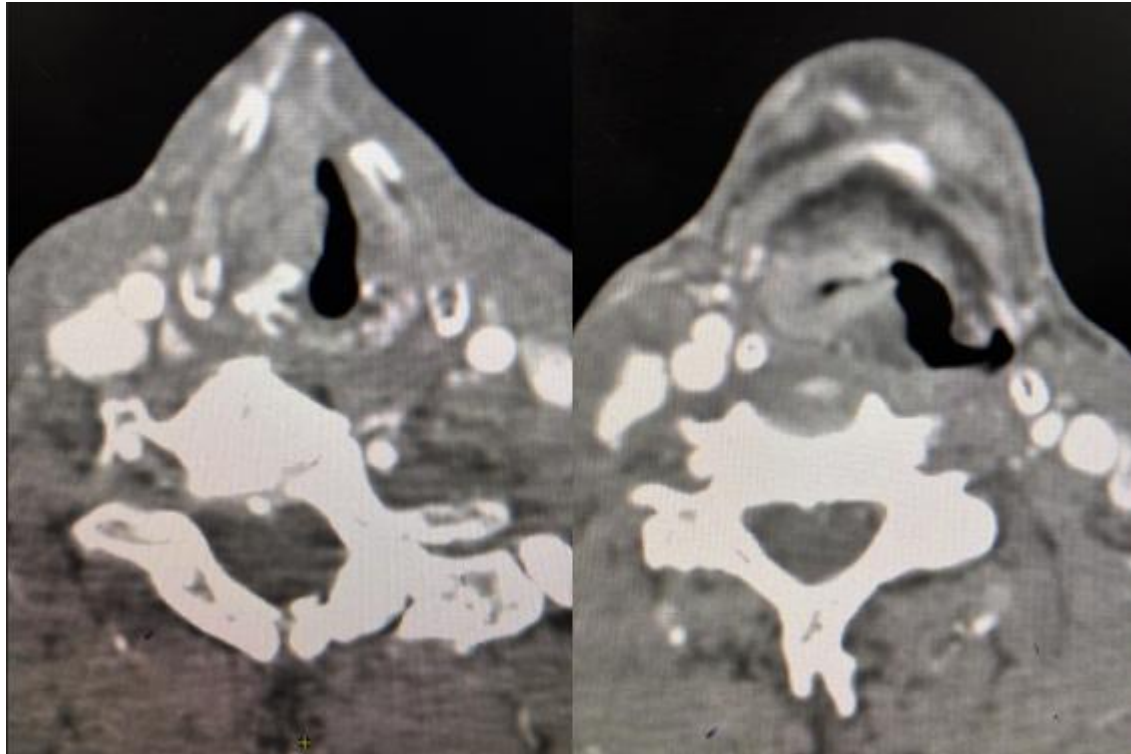


Figure: Axial contrast enhanced CT Image demonstrate involvement of right vocal cord by a mass arising from right Pyriform sinus with bilateral Lymphadenopathy

4. Review of Literature

The larynx, commonly known as the voice box, is a complex structure in the neck composed primarily of cartilage, ligaments, and muscles that functions to protect the airway during swallowing and produce sound for speech; it contains three large unpaired cartilages (thyroid, cricoid, and epiglottis), three pairs of smaller cartilages (arytenoid, corniculate, and cuneiform), and various intrinsic muscles which control vocal cord tension, all situated between the pharynx and trachea, allowing air to pass through while regulating its flow for sound production.

- a) **Cartilages:** The Thyroid, Cricoid, Arytenoid and Corniculate cartilages:
 - **Thyroid cartilage:** Anchors the vocal folds
 - **Cricoid cartilage:** Ring - shaped cartilage that marks the transition between the larynx and the trachea
 - **Arytenoid cartilages:** A pair of small, three - sided pyramids that attach to the vocal cords
 - **Corniculate cartilages:** They are a pair of small conical cartilages that extend the arytenoid postero - medially.
- b) **Ligaments:** The Median & Lateral cricothyroid ligament
- c) **Muscles:** Laryngeal muscles in the anterior neck are responsible for sound production
- d) **Epiglottis:** A small, leaf - shaped sheet of elastic cartilage that protects the larynx and helps with swallowing

Cancers of the larynx constitute about 25% of all head and Neck malignancies. Over 90% of these cancers are squamous cell carcinomas (SCC). Tobacco smoking and alcohol consumption are 4 important risk factors for laryngeal SCC. Approximately 30% of all laryngeal cancers arises in the supraglottic. They often present in advanced stages, because

symptoms (hoarseness, due to vocal cord involvement. Glottic SCCs represent the most common type. Hoarseness of voice due to vocal cord involvement is the primary presenting symptom in these patients. (Varsha M Joshi, Vineet Wadhwa, Suresh K Mukherji 2012) ¹

The average age of the SCC of larynx patients was 62.1 years. In terms of histopathology, 95% to 98% of cancer of the larynx is of squamous cell origin. Accounts for 30% to 40% of all malignant head and neck tumors. (Markou K, Christoforidou A, Karasmanis I, Tsiropoulos G, Triaridis S 2013) ²

Laryngeal carcinoma 91% of the cases and controls were male (mean age 60 years). Most of the cases had lower educational level and poorer socioeconomically status compared to controls, People of lower educational level and poor socioeconomically status had increased risk of getting laryngeal cancer. Found that head and neck malignancy was less common in higher economic group. (Arsenijevic S, Pantovic V, Gledovic Z, Stojanovic J) ³

They commonly present in adults between 50 and 70 years and show a strong male predominance. The presence of hoarseness, dysphagia, progressively worsening of upper airway obstruction and physical finding of absent laryngeal crepitus are the common presentations of laryngeal carcinoma as compared to thyroid carcinoma. (Chuen Shiun Chew, Irfan Mohamad, Nik Fariza Husna Nik Hassan, Shankar Ramasundram) ⁴

Relative survival of larynx cancer patients varies between 60% and 70% in Europe and North America, but is lower in developing countries. It is highly dependent on the subsite of the disease, which itself is dependent on the etiological factors involved. In countries with elevated alcohol consumption, the

prognosis is poorer because there are more tumors of the upper part of the larynx, which have a lower survival. (Parkin, D. M., Bray F., Ferlay, J. and Pisani, P. (2005), *Global Cancer Statistics, 2002*)⁵

5. Materials and Methods

- **Study Design:** Prospective Study
- **Duration:** October 2023 to September 2024
- **Setting:** Department of Radiodiagnosis, JLN Hospital Ajmer
- **Study Population:** 120 patients suspected of having laryngeal mass lesion referred from ENT department for CT scan.
- **Inclusion Criteria:** OPD/IPD/ICU patients with >20 - year age, all genders, with informed consent approved by local ethic committee.

6. Discussion

A study involving 120 patients with laryngeal mass symptoms was conducted at JLN Medical College, Ajmer. Study was carried out with a view to diagnose the patient with clinical complaints sign and symptoms related to larynx such as hoarseness or changes in voice and foreign body sensation in throat with history of smoking and tobacco and alcohol abuse. Patients were examined by ENT specialists and underwent Contrast Enhanced Computed Tomography (CECT) of the neck to evaluate suspected laryngeal pathologies. Biopsy results confirmed diagnoses, allowing for classification of tumors as benign or malignant.

CECT provides information about tumor volume, extension to and across the laryngeal ventricle, infiltration to surrounding spaces in pharynx, paraglottic, pre - epiglottic and extra laryngeal spaces all of which impact on the management and treatment options like potential for voice conserving partial laryngectomy and helps to access response to radiotherapy. CECT being simple, less expensive & reliable for diagnosis of laryngeal lesions and helps the assessment of intrinsic anatomy of the larynx and characteristic pattern of sub mucosal tumor extension, cervical lymph nodal status assessment of their prognosis.

Malignant tumors of the larynx may involve anterior commissures, vocal cords, ventricle, false cords, aryepiglottic folds, vallecula, and pyriform fossa, base of tongue, cricothyroid membrane, thyroid gland and muscles of neck. In our present study the malignant tumors of the larynx involve anterior commissure, vocal cords, ventricle, false cords, aryepiglottic folds, Vallecula, pyriform fossa, base of tongue, cricothyroid membrane, Thyroid gland and muscles of neck.

7. Results

The findings emphasized CECT's role in pre - therapeutic staging and treatment planning, influencing options like partial laryngectomy and radiotherapy.

Data of 120 patients was analyzed in this study including age & sex distribution of patients. Our present study out of 120 patient cases only 4 were benign two vocal cord polyp, one

laryngeal cyst and one vocal nodule. 116 cases were malignant lesions which are squamous cell carcinoma and its variants.

The results shows that out 116 malignant 114 were male and 2 were female and out of 4 benign lesions 2 were male and 2 were female. Out of 120 patients are 116 male and 4 female patients in this study. 97% of the study population comprises of males in this study & females comprise about 3% in this study.

In our present study 88% population were found in lower socioeconomic class 10% were found in middle class only 1.6% patient were found in upper socioeconomic class.

In our present study mostly present with, foreign body sensation, and voice changes, neck mass, dysphagia, and otalgia least common symptom.

Prevalence of Laryngeal cancer by site in our study

Location of Tumor	Number of Patients
Supraglottic	40
Glottic	74
Subglottic	2
Total	116

The above table shows out of 116 malignant lesion 74 were noted in glottic region and 40 were noted in supraglottic region and only 2 were noted in subglottic region. The above finding shows Glottic is the most common site of larynx cancer.

In our present study the malignant tumors of the larynx involve anterior commissure, vocal cords, ventricle, false cords, aryepiglottic folds, Vallecula, pyriform fossa, base of tongue, cricothyroid membrane, Thyroid gland and muscles of neck. In our present study we found that 8 patients with glottis cancer have isolated anterior commissures involvement, 8 patients have ventricle and false cord involvement only, 40 patients had both anterior commissure and arytenoid involvement, 16 patients have anterior Commissure, arytenoids, ventricle and false cord involvement, 2 patients had subglottic region involvement. There was no involvement of epiglottis, pre - epiglottic and paraglottic space. Involvement of thyroid and neck musculature were noted.

Pattern of spread in Glottic Cancer	Number of Patients	Percentage
AC involvement	8	10.81
AC+ Aryt+ Ven+ FC involvement	16	21.62
Ven+ FC involvement	8	10.81
AC+ Aryt involvement	40	54.05
SG involvement	2	2.70
Cartilage	18	24.32
Strap Muscle	10	13.51

Subglottic cancer is very well known for its propensity to involve Opposite side, cricothyroid membrane involvement, thyroid gland, tracheal and Muscular involvement. All the cases of subglottic cancer referred to us had cricothyroid membrane involvement extending into opposite site with Thyroarytenoid muscle involvement. Lymph nodal involvement is one of the important markers for prognosis of laryngeal cancer. The involvement of lymph nodes in all three

types of laryngeal cancer was assessed by CT and compared with prognosis

Supra glottic cancer and its involvement Patients with supraglottic cancer diagnosed by CT in our study is mostly located on epiglottis, false cord, followed by aryepiglottic fold. In our study population, 40 patients have supraglottic cancer appear to extend frequently to involve vallecula, base of tongue, piriform fossa, sometimes into glottis region. Among the patients diagnosed as having Supraglottic cancer in our study, out of 40 patients 24 of them were located in epiglottis - false cord region and 16 of them involve epiglottis - false cords well as aryepiglottic region.

Supraglottic Cancer and its Spread (n= 40)

Area affected by Supraglottic Cancer	Number of Patients	Percentage
Epiglottis- false cord region	24	60
Epiglottis- false cord aryepiglottic fold	16	40
Pre- epiglottic Space Involvement	26	65
Paraglottic Space Involvement	14	35
Vallecula	16	40

The above table shows that out of 40 supraglottic lesion 20 were show positive lymph node and 20 were nodes free.14 patients show good prognosis while 26 patients show bad prognosis. Out of 74 glottic lesion 22 were show positive lymph node and 52 were node free.46 patients show good prognosis and 28 were shows bad prognosis. All cases of subglottic lesion were node positive and shows bad prognosis.

Involvement of Lymph nodes by site in various types of Laryngeal Cancer

Nodes Involved	Supraglottic Cancer	Glottic Cancer	Subglottic Cancer
Upper Jugular	20	22	0
Middle Jugular	10	16	0
Lower Jugular	2	4	2
Posterior Triangle	2	2	2
Para tracheal	0	0	2

Out of 120 patients the 116 patients had malignant laryngeal masses diagnosed as SCC and its variants.70 (60%) cases were diagnosed as Well differentiated SCC, 26 (22.4%) cases were diagnosed Moderately differentiated SCC, 12 (10%) cases were diagnosed as poorly differentiated SCC, 5 cases were diagnosed as Verrucous type SCC, 1 patient was diagnosed as Basaloid SCC, 1 patient was diagnosed as papillary type SCC, 1 patient was diagnosed as spindle cell type SCC.4 cases with benign lesions also reported in our study, 1 case of them were vocal nodule, 2 cases of them were vocal polyp and 1 case of laryngeal Cyst.

Histological Types	No. of Patients
Well Differentiated SCC	70
Moderately Differentiated SCC	26
Poorly Differentiated SCC	12
Verrucous Cell SCC	5
Basaloid Cell type SCC	1
Papillary Cell Type SCC	1
Spindle Cell SCC	1
Total	116

In our present study out of 120 patients' cases 74 patients were found in glottic region. In which early T1 (32%) cases, T2, (29%) cases, T3 (24%) cases. Only 13% cases T4 stage. In our present study in supra glottic region out of 120 cases, 40 cases were found in which 55% cases have T3 stage, 20% cases have T4 Stage and 10% cases have T2 stage only 15% cases have T1 stage. In my present study only two patients noted in subglottic region with lymph node involvement shows T4 stage.

	Number of Patients	Percentage
Distant Metastasis	8	6.9
No Distant Metastasis	108	93.1

The above table shows that out of 116 malignant lesion 8 (6.9%) shows distant metastasis.

8. Summary and Conclusion

CECT plays a very vital role in diagnosis and staging of Laryngeal Cancers. It emphasizes the need for an integrated approach combining imaging findings with clinical evaluations to improve treatment outcomes for patients suffering from laryngeal masses.

CECT being simple less expensive reliable for diagnosis of laryngeal lesions and helps the assessment of intrinsic anatomy of the larynx and characteristic pattern of sub mucosal tumor extension, cervical lymph nodal status assessment of their prognosis.

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