www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v5i5.02

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Correlation of Endoscopic and CT scan Findings in Laryngeal Carcinoma

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ABSTRACT
Background: *Laryngeal carcinoma is a common cancer in Indian population. Early diagnosis and management of the disease can decrease the mortality rate of the disease. Endoscopy and computed tomography of larynx play vital roles in diagnosis of laryngeal carcinoma.*
Methods and Materials: *In a prospective study conducted in Department of ENT and Head & Neck Surgery, M.L.B. Medical College, Jhansi, U.P. we correlated the endoscopic and CT findings of larynx of 24 cases of laryngeal carcinoma.*
Aims: *To compare the endoscopic and CT larynx findings and correlation of them in diagnosing and staging of laryngeal carcinoma.*
Summary: *Laryngoscopy is better in detecting early mucosal changes of laryngeal cancer of various subsites as compare to CT scan. The few sites like ventricle, paraglottic space, pre epiglottic space can't be assessed by laryngoscopy but can be better assessed by CT scan as well as the extention of disease to cartilage and neck. Both help in staging of laryngeal carcinoma. The Findings of endoscopy and CT scan and clinical staging can be confirmed by pathological staging of the disease.*
Conclusion: *Laryngeal endoscopy and CT have their own advantages and disadvantages in diagnosing and staging of laryngeal cancer can be done more precisely when both endoscopic and CT findings are correlated.*
Keywords: *Laryngeal endoscopy, Computed tomography, Laryngeal cancer, TNM Staging.*

Introduction

The term larynx was first mentioned by Aristotle in 350 BC. In Indian medical history, Charaka Sanhita (100 AD) and Sushrutha Sanhita (300 AD) have suggested larynx as voice producing organ and various diseases of larynx. Visual examination of larynx, laryngoscopy, is vital in diagnosis of laryngeal diseases. Two techniques are used for examination of larynx namely- *Direct and Indirect laryngoscopy*

In modern era, examination of larynx started in 1829 when Babbington invented and used a three bladed device with a mirror and tongue retractor called glottiscope to directly visualize larynx. Kirstein developed the first direct laryngoscope with electric light as the source of light. Ultimately, in 1941 Miller developed a long bladed laryngoscope which was modified by MacIntosh with a curved blade with distal electric light source [3].

Manuel Garcis demonstrated examination of larynx with the help of dental mirror using sunlight as source of light on himself [1]. This discovery laid foundation for the development of

indirect laryngoscopy. In 1857, Johann Czermark used a laryngeal mirror and the light reflected by a perforated mirror held between the teeth to visualize the larynx[2]. Morell Mackenzie redesigned the Czermark's mirror and called it a "Laryngoscope".

In 1968, Sawashima and Hirose used flexible fibroscopes in the examination of the larynx. It had a 70° lens to visualize the larynx and subglottic area after applying local anaesthetics. This made the laryngoscopy a day care procedure. In 1974, Ward and Berci developed a laryngoscope with a 90° angled Hopkins lens which is still used for photoscopic documentation of the larynx. In 1978, Overtel was the first to perform stroboscopy which is very much helpful to differentiate functional and anatomical defects [5]. In 1960, Kleinsasser modified Zeiss operating microscope to examine the larynx under general anaesthesia [4].

The role of radiological investigations came into limelight due to shortfall of laryngoscopy which missed few hidden zones in the larynx. In 1895 Roentgen discovered X-rays which was soon used for clinical imaging in form of conventional radiography [12]. Leborgne described tomographic study of larynx with X-rays in 1940 and conventional tomography was commercially available from 1950. First computerized tomography was installed in 1971 by Hounsefield [13]. Following that, CT has become a reliable technique for diagnosing diseases of the larynx. In 1978, Mancuso first used computerized tomography to study larynx in a case of carcinoma of larynx [6].Nowadays, CT is widely used for evaluation of laryngeal carcinoma and its staging. Charlin in 1989 compared the roles of endoscopy and CT in assessing the laryngeal carcinoma [7].

In larynx, squamous cell carcinoma is the commonest cancer but other malignancies like verrucous carcinoma, adenoid cystic carcinoma, chondrosarcoma, carcinosarcoma, fibrosarcoma can also be encountered [14]. They usually present with hoarseness of voice, neck swelling, dyspnoea, stridor, dysphagia, cough, odynophagia and/or hemoptysis.

As per the available literature, even though endoscopic examination and CT both can be used to diagnose and stage the laryngeal cancer one is better than the other in certain perspectives. In this study, we have compared the efficacy of endoscopic examination and computed tomography of larynx as modalities in the diagnosis and staging of laryngeal carcinoma.

Aims

- Our aim was to compare the efficacies of laryngeal endoscopic examination and laryngeal CT in diagnosing and assessing the extension of cancer.
- To find out which parts of larynx are better seen in endoscopy and CT respectively.

Methods and Materials

This is a prospective observational study conducted in 35 patients who presented to the outpatient department with the complaints of persistent hoarseness of voice, difficulty in swallowing, neck swelling, painful swallowing, stridor and/or cough with or without blood mixed expectoration.

All the patients were admitted and underwent thorough history taking, local examination and indirect laryngoscopy. CT (contrast enhanced) of larynx and neck was done. Following this, all the patients underwent rigid and/or flexible endoscopy under either local or general anesthesia. Findings were recorded.

Out of 35 cases, 32 had laryngeal structural lesion(s) in form of a swelling or ulcer. For these cases biopsy was taken from the lesion at the time of endoscopy for histopathological examination. By biopsy, 24 patients were found to have carcinoma of larynx. Correlation of findings from endoscopy and CT was done in our study.

Observation

In our study, initially we involved 35 patients out of whom 33 (94.3%) were males and 2 (5.7%)

were females. They were belonging to the age group ranging from 30 years to 85 years with maximum patients belonging to the age group of 51-60 years. Hoarseness of voice was the commonest presenting symptom with 94.3% (n=33) cases. The diagnosis of the patients turned out to be carcinoma in 24 cases (68.5%) by biopsy. The endoscopic and CECT findings of these 24 patients and their correlation are tabulated below.

Endoscopic findings are mentioned in table 1:

Table 1:

Sites	Carcinoma (n=24)	
	Growth/ Swelling	Oedema / Mucosal Thickening
Epiglottis	21 (87.5%)	1 (4.2%)
Arytenoid	16 (66.7%)	0 (0%)
Aryepiglottic folds	19 (79.2%)	3 (12.5%)
False vocal cords	18 (75%)	4 (16.7%)
Laryngeal ventricle	4 (16.7%)	0 (0%)
Pre epiglottic space	0 (0%)	0 (0%)
Vallecula	0 (0%)	3 (12.5%)
Pyriform sinus	11 (45.8%)	4 (16.7%)
True vocal cords	22 (91.7%)	1 (4.2%)
Anterior commisure	5 (20.8%)	3 (12.5%)
Posterior commisure	12 (50%)	0 (0%)
Paraglottic space	0 (0%)	0 (0%)
Subglottis	2 (8.3%)	0 (0%)

CT findings are mentioned in table 2:

Table 2:

Sites	Carcinoma (n=24)	
	Growth/ Swelling	Oedema / Mucosal Thickening
Epiglottis	22 (91.7%)	0 (0%)
Arytenoid	17 (70.8%)	0 (0%)
Aryepiglottic folds	22 (91.7%)	0 (0%)
False vocal cords	22 (91.7%)	0 (0%)
Laryngeal ventricle	2 (8.3%)	0 (0%)
Pre epiglottic space	13 (54.2%)	0 (0%)
Vallecula	2 (8.3%)	0 (0%)
Pyriform sinus	15 (62.5%)	0 (0%)
True vocal cords	23 (95.8%)	0 (0%)
Anterior commisure	8 (33.3%)	0 (0%)
Posterior commisure	12 (50%)	0 (0%)
Paraglottic space	9 (37.5%)	0 (0%)
Subglottis	4 (16.7%)	0 (0%)

Frequency of cartilage invasion in table 3:

Table 3:

Cartilage	Endoscopy	CT
Thyroid cartilage	0 (0%)	6 (25%)
Cricoid cartilage	0 (0%)	2 (8.3%)
Arytenoid cartilage	16 (66.7%)	17 (70.8%)
Epiglottis	21 (87.5%)	22 (91.7%)

Site wise distribution of Carcinoma by endoscopy and CT in table 4:

Table 4:

Parts	Endoscopy	CT
Supraglottis	2 (8.3%)	1 (4.1%)
Glottis	2 (8.3%)	2 (8.3%)
Supraglottis and glottis	18 (75%)	17 (70.8%)
Subglottis	0 (0%)	0 (0%)
Supraglottis, glottis and subglottis	2 (8.3%)	4 (16.7%)

Comparison of Indirect laryngoscopic, Endoscopic and CT findings of carcinoma in table 5:

Table 5:

Parts	Indirect Laryngoscopy	Endoscopy	CT
Epiglottis	20 (83.3%)	21 (87.5%)	22 (91.7%)
Aryepiglottic folds	18 (75%)	19 (79.2%)	22 (91.7%)
False vocal cords	18 (75%)	18 (75%)	22 (91.7%)
Arytenoid	15 (62.5%)	16 (66.7%)	17 (70.8%)
Pre epiglottic space	0 (0%)	0 (0%)	13 (54.2%)
Laryngeal ventricle	0 (0%)	4 (16.7%)	2 (8.3%)
Vallecula	0 (0%)	0 (0%)	2 (8.3%)
Pyriform sinus	10 (41.7%)	11 (45.8%)	15 (62.5%)
True vocal cords	21 (87.5%)	22 (91.7%)	23 (95.8%)
Anterior commisure	2 (8.3%)	5 (20.8%)	8 (33.3%)
Posterior commisure	10 (41.7%)	12 (50%)	12 (50%)
Paraglottic space	0 (0%)	0 (0%)	9 (37.5%)
Subglottis	0 (0%)	2 (8.3%)	4 (16.6%)

T staging of carcinoma by endoscopy and CT in table 6:

Table 6:

T stage	No. of cases detected by Endoscopy	No. of cases detected by CT
T1	4 (16.7%)	3 (12.5%)
T2	5 (20.8%)	3 (12.5%)
T3	15 (62.5%)	12 (50%)
T4	0 (0%)	6 (25%)

Out of the 24 cases of laryngeal cancer, 19 patients were having lymphadenopathy in the neck. Frequency of detecting nodal metastasis between clinical palpation and CT is shown in table 7:

Table 7:

Level	Clinical examination	CT
I	1 (5.3%)	1 (5.3%)
II	10 (52.6%)	10 (52.6%)
III	6 (31.6%)	6 (31.6%)
IV	1 (5.3%)	1 (5.3%)
V	1 (5.3%)	1 (5.3%)
VI	0 (0%)	0 (0%)

Frequency of false negatives in locating the sites by endoscopy in table 8:

Table 8:

Site	No. of cases	Percentage
Thyroid cartilage	6	25%
Cricoid cartilage	2	8.3%
Paraglottic space	9	37.5%
Pre epiglottic space	13	54.2%
Anterior commisure	3	12.5%
Subglottic space	2	8.3%

False negatives in CT in table 9:

Table 9:

Site	No. of cases	Percentage
Laryngeal ventricle	2	8.3%

False positives in CT scan compared to Endoscopy in table 10:

Table 10:

Site	Number of cases	Percentage
Vallecula	3	12.5%
Pyriform sinus	4	16.7%
Aryepiglottic fold	3	12.5%
False vocal cords	4	16.7%
Epiglottis	1	4.16%
True vocal cords	1	4.16%
Anterior commissure	3	12.5%
Posterior commissure	2	8.3%

Discussion

In our study of 24 patients, 23 cases were squamous cell carcinoma and 1 was verrucous carcinoma which is a variant of squamous cell carcinoma. On comparing the findings of laryngeal endoscopy and CT neck mentioned in the observation, following findings were noted.

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 [Table 1 and 2]

Growth in epiglottis was detected by endoscopy in 87.5% cases whereas in 91.7% cases by the CT, arytenoids cartilage was detected by endoscopy in 66.7% and CT scan in 70.8%, whereas growths in thyroid cartilage and cricoids cartilage are totally missed by the endoscopy [Table 3]. This inference of our study is also supported by the results of Lloyd G.A. et al study [11]

Laryngeal cancers at T4 stage cannot be identified by endoscopy as the endoscopic examination cannot identify cartilage invasions and extra cartilage spread [Table 6]. Hence there is down-staging of tumors from T4 to T3 if the diagnosis is based only on endoscopy.

Growth in aryepiglottic fold was detected by endoscopy in 79.2% whereas it was as high as 91.7% by the CT scan. Charlin et al study showed false positive rate in the CT detecting aryepiglottic fold growth was 33.3% [7] but in our study the false positivity was only 12.5%.

The growth in false vocal cord was detected in 75% cases by endoscopy and in 91.7% cases by CT. In our study, CT scan overestimated the growth in 16.7% cases. Charlin et al says the false positivity in their study was 15.1%. This false positive result was due to the failure of CT scan to differentiate the edema from tumor growth.

Endoscopy could not visualize the preepiglottic space and hence the false negative rate was as high as 54.2%. Here CT is effective in detecting the pre epiglottic invasion. This factor is of high importance as involvement of cancer in pre epiglottic space upgrades the T stage to T3 [8].

According to Charlin et al false negative was seen in 37.8% case which is lesser than our study. It is similar in case of paraglottic space also where endoscopy could not detect any lesion whereas CT scan could diagnose the disease in 37.5% cases.

Laryngeal ventricle is less described by a CT scan and hence half of the cases (2 out of 4) were missed by CT scan whereas all of them were detected by endoscopy. But in case detecting the lesions in vallecula CT scan (8.3%) is better than endoscopy (0%) as per our study.

Based on the above mentioned results we can come into the conclusion that endoscopy and CT scan have their own advantages and few drawbacks. Hence a combined use of both endoscopy and CT scan of the larynx can yield a more accurate diagnosis of laryngeal carcinoma. Similar findings were mentioned in few older literatures in the past [8].

Conclusion

- Early mucosal changes are picked up better by endoscopic examination of larynx whereas extra laryngeal extensions are better identified by CT of larynx.
- Nodal metastasis of laryngeal cancers is diagnosed by CT with clinical correlation.
- Laryngeal ventricle is better assessed by CT than endoscopy.
- Hence combined assessment of tumor by endoscopy and CT of larynx plays a vital role in better diagnosis and management of Laryngeal cancers.

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