

Comparison between 70 degree endoscopy, direct laryngoscopy and CT scan in T staging of Laryngeal cancer

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Abstract

The purpose of the study was to study and compare the importance of 70 degree endoscopy, direct laryngoscopy and CT scan in showing the extent of laryngeal tumours which would then decide the course of treatment for the patient. A total of 25 patients were included in the study and all patients underwent 70 degree endoscopy, direct laryngoscopy and CT scan examination. The CT scan findings were taken as gold standard and the T staging of the laryngeal tumours was compared with 70 degree endoscopy and direct laryngoscopy which was done using Cohens Kappa statistics. The sensitivity of 70 degree endoscopy in staging T1 laryngeal tumors was 100%, T2 tumors was 57.1%, T3 tumors was 62.5 % and T4 tumors was 0. The overall staging accuracy of 70 degree endoscopy was 0.44. The sensitivity of direct laryngoscopy in staging T1 laryngeal tumors was 100%, T2 tumors was 100%, T3 tumors was 62.5 % and T4 tumors was 0. The overall staging accuracy of direct laryngoscopy was 0.56.

Keywords: 70 degree endoscopy, Direct laryngoscopy, CT scan T staging, Laryngeal cancer.

Introduction

Cancer of the larynx remains the second most common head and neck malignancy, constituting 25% of all tumors. In 2002, 8,900 new cases of larynx cancer were predicted with a 3.5:1 male to female ratio and a total of 3,700 cancer deaths associated with these malignancies.⁽¹⁾

For supraglottic tumors, patients will often describe pain, sore throat, otalgia, dysphagia, foreign body sensation, and, if the cancer extends to the vocal folds, hoarseness. Patients with supraglottic tumours frequently have cervical lymph node metastases. Glottis cancer nearly always causes hoarseness as the initial symptom, with some patients experiencing a chronic cough or need for throat clearing. It is rare for true vocal cord cancers without extension outside the glottis to metastasize to cervical lymph nodes. Subglottic tumors are very rare and have similar symptoms, but are known to spread to cervical lymph nodes.⁽²⁾

Office endoscopy is critical in laryngeal cancer patients to assess not only the exact structures involved by the tumour, but also to evaluate the mobility of the true vocal cords, which is important in staging of laryngeal cancers.⁽²⁾ Imaging studies give important information regarding the extent of the tumour which helps to stage the cancer and plan treatment. For example, invasion of the pre-epiglottic space, paraglottic space, or thyroid cartilage are features that can be seen on imaging but not on physical examination. Cervical lymph nodes are evaluated as well.⁽²⁾ Imaging studies also help in the post-therapeutic surveillance and follow-up of patients with laryngeal cancers.⁽³⁾

For patients with suspicious laryngeal lesions, tissue diagnosis is accomplished by biopsy in the operating room, during the laryngoscopy, precise tumor mapping can be performed. In this study we compared the extent of laryngeal cancer by T staging between 70 degree endoscopy, direct laryngoscopy and CT scan.

Materials and Method

This is a retrospective study that was carried out in the department of E.N.T for a period of two years, from October 2013 to September 2015, in a tertiary care hospital. Patients of either sex, above the age of 10 years and who presented with a laryngeal lesion which was diagnosed as laryngeal cancer by histopathological examination were included in the study.

Each patient was thoroughly examined clinically, including indirect laryngoscopy. This was followed by routine investigations, plain X-ray neck (AP/Lateral) and Ba Swallow wherever required, endoscopic examination of the laryngeal and laryngopharyngeal regions with 70 degree endoscope, direct laryngoscope under required anesthesia and contrast enhanced CT examination of the neck. Histopathological examination was done in all cases.

A total of 25 patients were included in this study.

70 degree endoscopy: A Karl Storz 70 degree, 4mm rigid endoscope was used for examination of the larynx and laryngopharynx. The procedure was explained to the patient. The patient's soft palate and posterior tongue were anaesthetized with 4% Xylocaine spray (lidocaine).

CECT Neck: After taking written and informed consent, contrast enhanced CT scan examination was done by MDCT 16 slice, Toshiba Activion. Axial,

coronal and saggital slices with 3 mm thickness were acquired after intravenous, iodinated contrast media injection at a dose of 1.0–2.0 ml/kg, and 60–76% concentration, with the patient in supine position with neck extension, during calm respiration and without deglutition. Very thin sections (1.0–1.5 mm) with multiplanar reconstructions limited to the larynx were obtained.

Direct laryngoscopy: Direct laryngoscopy with biopsy for suspected malignant growths was performed under general anesthesia without neuromuscular blockage and intraoral endotracheal intubation.

The patient was placed in the 'sniffing the morning air'⁽⁴⁾ position i.e. the head well extended on the atlas and the neck flexed. The Kleinsasser laryngoscope with fibre optic channel for illumination was used. The laryngeal lesions were examined and biopsies were obtained. Patients presenting with stridor underwent tracheostomy before undergoing direct laryngoscopy.

The extent, i.e. T staging, of the diagnosed malignant laryngeal lesions was compared between direct laryngoscopy, 70 degree endoscopy and CT scan.

Taking CT scan as gold standard comparison of 70 degree endoscopy and Direct laryngoscopy for staging and extent of the malignant lesions was done using Cohens Kappa statistics.

Results

An overall population of 25 patients was included in this study, of whom 23 (92%) were males and 2 (8%) were females. The highest incidence was seen in the 6th decade i.e. 10 patients (40%). Out of the 25 cases of laryngeal malignancy 24 patients (96%) had squamous cell carcinoma and 1 (4%) patient had verrucous carcinoma on histopathological examination.

Based on CT scan (taken as gold standard), 2 (8%) malignancies had T1 staging, 7 (28%) malignancies had T2 staging and 8 (32%) malignancies had T3 and T4 staging each. Based on 70° endoscopy, 5 (20%) malignancies had T1 stage, 7 (28%) malignancies had T2 and 13 (52%) had T3 staging. There were no cases staged as T4. Using Direct laryngoscopy, 2 (8%) malignancies had T1 stage 10 (40%) malignancies had T2 staging and 13 (52%) malignancies had T3 staging. There were no cases staged as T4.

Table 1: Distribution of patients with laryngeal malignancies according to T staging diagnosed by 70 degree endoscopy, direct laryngoscopy and CT

T stage	CT Scan	70 degree endoscopy	Direct laryngoscopy
T1	2 (8%)	5 (20%)	2 (8%)
T2	7 (28%)	7 (28%)	10 (40%)
T3	8 (32%)	13 (52%)	13 (52%)
T4	8 (32%)	0	0
Total	25	25	25

On comparing 70 degree endoscopy to CT scan findings there were 2 cases of T1, 4 cases of T2 and 5 cases of T3 stage that showed perfect agreement between the methods. Eight cases of T3 staging on 70° endoscopy were diagnosed as T4 by CT scan. Further, 3 cases of T2 staging on 70° endoscopy were diagnosed as T3 on CT scan. The overall agreement between two methods was obtained using Cohen's Kappa coefficient. The estimate obtained was 0.2424 (95% CI: -0.0208 – 0.5057) with standard error of 0.1343 indicating fair agreement. The z-statistic obtained was 1.8049 with a p-value of 0.0355 ($p < 0.05$). This implies the agreement between the two methods is not by chance.

The overall staging accuracy of 70 degree endoscopy was 0.44 (95% CI: 0.244 – 0.651).

Table 2: Validation parameters for 70° endoscopy compared to CT scan

Statistical parameter	Stages			
	T1	T2	T3	T4
Sensitivity	100	57.1	62.5	0.000
Specificity	86.9	83.3	52.9	100

On comparing direct laryngoscopy to CT scan findings two cases were identified with T1 staging by both the methods, while 7 were identified as T2 and 5 cases identified as T3 by both. There were 8 cases identified as T3 by direct laryngoscopy and T4 by CT scan. Three cases were identified as T2 on direct laryngoscopy and T3 on CT scan. Cohen's Kappa coefficient was obtained on the data set which results into an estimate of 0.3848 (95% CI: 0.1127 – 0.6569) and standard error of 0.1388 indicating fair agreement. The z-statistic obtained was 2.7723 with associated p-value of 0.0027 ($p < 0.05$). This implied that the estimated kappa coefficient was not a chance occurrence.

The overall staging accuracy of direct laryngoscopy was 0.56 (95% CI: 0.349 – 0.756).

Table 3: Validation parameters for direct laryngoscopy compared to CT scan

Statistical parameter	Stages			
	T1	T2	T3	T4
Sensitivity	100	100	62.5	0.00
Specificity	100	83.3	52.9	100

Discussion

In our study out of 25 patients, 23 (92%) were males and 2 (8%) were females. In a study by Aragao Jr AGM et al,⁽⁵⁾ out of 39 patients of laryngeal cancer, thirty-three patients (84.6%) were men and six (15.4%) women, corresponding to men: women ratio of 5.5:1.

In our study the highest incidence was seen in the 6th decade i.e. 10 patients (40%). Joshi et al⁽³⁾ reported that the mean age of laryngeal carcinoma is between 50

and 70 years. In our study, out of the 25 cases of laryngeal malignancy 24 patients (96%) had squamous cell carcinoma and 1 (4%) patient had verrucous carcinoma on histopathological examination.

In our study out of 25 cases of laryngeal malignancies 2 cases (8%) presented in the T1 stage, 7 cases (28%) presented in the T2 stage and 8 cases (32%) each presented in the T3 and T4 stage. Mastronikolis et al⁽⁶⁾ in their study reported that more than 95% of laryngeal tumors are squamous cell carcinomas.

In a study by Iseh KR et al,⁽⁷⁾ out of 37 cases of laryngeal tumours, histological diagnosis was obtained for 30 cases out of which 20 (66.7%) showed squamous cell carcinoma. In our study, out of 25 cases of laryngeal malignancies there were 2 (8%) cases staged as T1, 7 (28%) cases staged as T2, 8 (32%) cases staged as T3 and T4 each.

In a study by Aragao Jr. AGM et al⁽⁵⁾ 39 patients of laryngeal cancer (supraglottic) were studied retrospectively. There were 5 (12.82%) cases staged as T2, 23 (58.97%) staged as T3 and 11(28.2%) staged as T4. There were no cases staged as T1.

In a study by Rashad Rafiq Matoo et al⁽⁸⁾ newly diagnosed 25 patients with laryngeal and hypo pharyngeal malignancies over a period of one and a half year from April 2014 to September 2015 were studied. Out of a total of 25 patients, there were 12 (48%) patients with glottic malignancy out of which 7 (58.33%) belonged to T2 and 5 (41.67%) belonged to T3 class. There were 8 (32%) patients with supraglottic malignancy out of which 6 (75%) belonged to T2 and 2 (25%) belonged to T3 class. Out of 5 (20%) patients with Hypopharyngeal malignancy 4 (80%) patients belonged to T2 and 1 (20%) patient belonged to T3 class.

In our study out of 25 cases of laryngeal malignancies 70 degree endoscopy correctly staged 11 cases (44%) and it failed to correctly stage 14 cases (56%) due to invasion of subglottis (3 tumours), preepiglottic space (3 tumours) and paraglottic and extralaryngeal spread (8 tumours). CT scan staged all cases correctly.

On comparison, statistical analysis indicated a fair agreement between 70 degree endoscopy and CT scan in T staging of laryngeal malignancies. The sensitivity of 70 degree endoscopy in staging T1 laryngeal tumors was 100%, T2 tumors was 57.1%, T3 tumors was 62.5% and T4 tumors was 0. The overall staging accuracy of 70 degree endoscopy was 0.44.

Direct laryngoscopy correctly staged 14 cases (56%) and it failed to correctly stage 11 cases (44%) due to invasion of preepiglottic space (3 tumours) and paraglottic and extralaryngeal spread (8 cases). CT scan staged all cases correctly.

On comparison, statistical analysis indicated a fair agreement between direct laryngoscopy and CT scan in T staging of laryngeal malignancies. The sensitivity of

direct laryngoscopy in staging T1 laryngeal tumors was 100%, T2 tumors was 100%, T3 tumors was 62.5% and T4 tumors was 0. The overall staging accuracy of direct laryngoscopy was 0.56.

In a study by Zbaren P et al,⁽⁹⁾ out of 40 cases of laryngeal carcinoma, clinical/endoscopic evaluation failed to correctly stage 17 tumors due to invasion of the paraglottic space (1 tumor), preepiglottic space (2 tumors), and extralaryngeal soft tissues (14 tumors). Clinical/endoscopic evaluation had a staging accuracy of 57.5%.

In a study by T. Ferri et al,⁽¹⁰⁾ the staging accuracy of direct laryngoscopy was 51.3% and CT scan was 70.1%. Out of the 25 cases of laryngeal malignancies 70 degree endoscopy staged 5 cases (20%) as T1, 7 cases (28%) as T2 and 13 cases (52%) as T3. No case was staged as T4. 70 degree endoscopy correctly assessed 2 cases (8%) of T1 stage, 4 cases (16%) of T2 stage and 5 cases (20%) of T3 stage. 14 lesions (56%) were wrongly staged by endoscopy i.e. 3 cases (12%) as T1 stage, 3 cases (12%) as T2 stage and 8 cases(32%) as T3 stage.

Direct laryngoscopy staged 2 cases (8%) as T1, 10 cases (40%) as T2 and 13 cases (52%) as T3. No case was staged as T4. Direct laryngoscopy correctly assessed 2 cases (8%) of T1 stage, 7 cases (28%) of T2 stage and 5 cases (20%) of T3 stage. 11 lesions (44%) were wrongly staged by direct laryngoscopy i.e. 3 cases (12%) as T2 stage and 8 cases(32%) as T3 stage. CT scan staged 2 cases (8%) as T1, 7 cases (28%) as T2 and 8 cases (32%) each as T3 and T4. All cases were correctly assessed.

In a study by Barbosa MM et al,⁽¹¹⁾ out of 52 glottic and supraglottic laryngeal squamous cell carcinoma patients, clinical endoscopic classification was correct in 40.38% of cases (40% for T1, 29.41% for T2, 46.43% for T3, and 50% in T4). In our study 70 degree endoscopy correctly assessed 8% of T1 stage, 16% of T2 stage and 20% of T3 stage and Direct laryngoscopy correctly assessed 8% of T1 stage, 28% of T2 stage and 20% of T3 stage.

In our study CT scan resulted in upstaging of 14 (56%) cases out of 25 cases of laryngeal cancer, as compared to endoscopy and substaging was not present in any case. Charlin B et al⁽¹²⁾ in 1989 compared endoscopic findings in 66 consecutive previously untreated cases of laryngeal cancer. CT scan alone under staged laryngeal cancer in 10.6% of cases, all of them being superficial spreading tumours within the larynx or juxta laryngeal. CT scan caused upstaging in 22.7% cases, all of them being deep invasion overlooked by endoscopy. CT was most useful in lesions initially classified as T2 and T3, which included all those reclassified by CT. None of the T1 lesions were upgraded by CT scan.

In our study CT scan did not understage any tumour and caused upstaging in 14 (56%) as compared to endoscopy. Out of these 3 cases (12%) staged as T1

on endoscopy were upstaged to T2, 3 cases (12%) staged as T2 on endoscopy were upstaged to T3 and 8 cases (32%) staged as T3 on endoscopy was upstaged to T4. CT scan was useful in lesion initially classified as T1, T2 and T3.

Lisa Barbera et al⁽¹³⁾ in a study of 1195 patients with laryngeal cancer showed that CT scan altered T class in 20.2% patients and most of them being upstages. In our study CT scan upstaged 56% of the cases. In the study by Aragao Jr AGM et al,⁽⁵⁾ CT scan resulted in upstaging of 38.5% lesions and substaging of 5.12% of lesions.

In a study by Rashad Rafiq Matoo et al⁽⁸⁾ the comparison of clinical tumor staging with clinic-radiological tumor staging of the patients under study was done. They observed that there were 10 (40%) patients in stage II clinically and after radiological evaluation only 8 (32%) patients belonged to stage II while as remaining 2 (8%) patients were upstaged to stage IV. There were 13 (52%) patients in stage III clinically and after radiological evaluation 8 (32%) patients were in stage III while as remaining 5 (38.46%) patients were upstaged to stage IV. There were 2 (8%) patients in stage IV clinically and after radiological evaluation 9 (36%) patients were recorded in stage IV. Overall there were 7 patients (28%) who were upstaged which included 2 patients (8%) from stage II and 5 patients (20%) from stage III.

Conclusion

For laryngeal tumours, staging accuracy of CT scan is the best. 70 degree endoscopy understages the tumours due to inability to see the hidden areas of the larynx and laryngopharynx. Also 70 degree endoscopy and direct laryngoscopy understages tumours due to inability to see the extent of tumours into the paraluminal spaces and extra laryngeal region. Thus, CT examination in laryngeal and laryngopharyngeal cancer is an extremely crucial step, after clinical examination and laryngoscopic evaluation, to know the extent of the tumour, on the basis of which further management is decided for the patient.

References

1. Smith RV, Fried MP. Advanced cancer of the larynx. Byron J. Bailey, Jonas T. Johnson, Shawn D. Newlands (eds). *Head & Neck Surgery—otolaryngology*, Volume 1. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2006. pp. 1758-59.
2. *Head and Neck Cancer: Current Perspectives, Advances, and Challenges*. Springer Science & Business Media 2013. pp. 535.
3. Varsha M Joshi, Vineet Wadhwa, Suresh K Mukherji. Imaging in laryngeal cancers. *Indian J Radiol Imaging* 2012;22(3):209–226.
4. Gray R. Laryngoscopy and micro laryngoscopy. Hugh Dudley, David Carter(eds). *Rob & Smith's Operative Surgery* 4th ed. London: Chapman & Hall; 1994. pp. 252-56.
5. Aragao Jr AGM, de Souza RP, Rapaport A. Computed tomography contribution to the staging of supraglottic squamous cell carcinoma. *Radiologia Brasileira* 2007;40(4).
6. Nikolaos S Mastronikolis, Theodoros A Papadas, Panos D Goumas, Irene-Eva; Head and neck. Laryngeal tumors: an overview. *Atlas Genet Cytogenet Haematol* 2009;13(11):888-893.
7. Iseh KR, Abdullahi M, Aliyu D. Laryngeal tumours: clinical pattern in Sokoto, Northwestern Nigeria. *Niger J Med* 2011;20(1):75-82.
8. Rashad Rafiq Mattoo, Sajad Majid Qazi, Basharat Rashid, Zubair Lone, Junaid Nazir Dandroo. Clinic-endoscopic and radiological assessment in the pre-therapeutic staging of laryngeal and hypopharyngeal malignancies. *J Biol Sci Opin* 2016;4(5):159-170.
9. Zbären P, Becker M, Läng H. Pre-therapeutic staging of laryngeal carcinoma: Clinical findings, computed tomography, and magnetic resonance imaging compared with histopathology. *Cancer* 1996;77(7):1263-73.
10. Ferri T, De Thomasis G, Quaranta N, Bacchi G, Bottazi D. The value of CT scans in improving laryngoscopy in patients with laryngeal cancer. *European archives of Otorhino-laryngology* 1999;256(8):395-99.
11. Barbosa MM, Araujo V, Boasquevisqu E, Carvalho R, Romano S. Anterior vocal commissure invasion in laryngeal carcinoma diagnosis. *Laryngoscope* 2005;115(4):724-730.
12. Charlin B, Brazeau-Lamontagne L, Guerrier B, Leduc C. Assessment of laryngeal cancer: CT scan versus endoscopy. *Journal of Otolaryngology* 1989;18(6):283-8.
13. Lisa Barbera. The role of computed tomography in the T classification of laryngeal carcinoma. *Cancer* 2001;91(2):394-407.