

Computed tomography based staging in the carcinoma of the larynx

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Abstrak

Karsinoma laring mewakili kira-kira sepertiga dari keganasan leher dan kepala dan merupakan satu diantara keganasan yang paling sering di India. Untuk mengevaluasi peranan CT scan dalam proses "staging" karsinoma laring, dua puluh penderita telah dipelajari. Semua penderita adalah laki-laki dengan rata-rata usia 54 tahun. Laringoskopi langsung dan tidak langsung memberi hasil 1) tumor glottis (55%) dan 9 tumor supraglottis (45%). Secara histologis, semua tumor berjenis karsinoma skuamosa. Staging klinis dan CT dilakukan berdasarkan kriteria AJCC 1988. CT upstaging terjadi pada 13 kasus (65%). Beberapa invasi tumor hanya terdeteksi dengan CT: daerah tiroaritenoid (55%) pasca laring (50%), di bawah pita suara (45%), sinus piriformis (35%), komisura anterior (25%), invasi kartilago (25%), daerah preepiglottis (20%), pasca krikoid (15%), komisura posterior (15%) dan subglottis (10%). Keterlibatan kelenjar getah bening terdeteksi pada tiga penderita (15%).

Abstract

Carcinoma of the larynx represents approximately one third of all head and neck cancers and is amongst the commonest head and neck malignancy in India. In order to evaluate the role of computed tomography in staging laryngeal carcinoma, twenty consecutive patients of subsequently proved carcinoma of the larynx were recruited in this study. All the patients were males with average age of 54 years. Indirect and direct laryngoscopy revealed 11 tumours to be glottic (55%) and 9 tumours to be supraglottic (45%). Histologically, all tumours were squamous cell carcinomas. The clinical and CT staging was done according to AJCC 1988 staging system. CT upstaging of the carcinoma occurred in 13 cases (65%). Certain invasions were detected only on CT: thyroarytenoid space (55%) paralaryngeal space (50%), undersurface of true vocal cords (45%), pyriform sinus (35%), anterior commissure (25%), cartilage invasion (25%), pre-epiglottic space (20%), post cricoid (15%), posterior commissure (15%) and subglottic extension (10%). Lymph node involvement was detected in three patients (15%).

Keywords: Laryngeal carcinoma, computed tomography, larynx, CT staging.

Carcinoma of the larynx represents approximately one third of all head and neck cancers.¹ Almost all malignancies of the larynx arise from the mucosal surface and thus are accessible to direct visualization and biopsy. The radiologist evaluates areas that the clinician cannot see, such as areas deep to the mucosa or blocked from direct visualization by the bulk of the tumour.² The goal of the radiologic study is to help determining the most appropriate therapy. Modern laryngeal imaging uses either computed tomography (CT) or magnetic resonance (MR) imaging to show

the relationship of disease to the very small laryngeal structures. Even in patients who cannot co-operate completely, CT offers a consistently good examination, with short imaging times and thin section.² Better geometric delineation of the anatomy of the larynx is likely to improve staging and radiation treatment of the carcinoma of the larynx as compared to clinical staging, especially for supraglottic and glottic cancers.^{3,4,5}

This study was undertaken to assess the role of computed tomography based staging for the staging of carcinoma of the larynx.

METHODS

The study comprised 20 patients who attended otorhinolaryngeal Outpatients Department with suspected growth of the larynx. All the patients were

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examined clinically, including indirect laryngoscopy and had M₀ disease. Direct laryngoscopy was undertaken in all patients and clinical staging was done. Radiological examination included radiography of the neck and chest soft tissue and contrast enhanced computerised tomography (CT). CT was done on Shimadzu SCT 3000 TF scanner. Sections were obtained parallel to the laryngeal ventricle as seen on lateral scout view with the patient in the treatment position. If the ventricle was not identified, CT gantry angle was adjusted so that the scan beam was parallel to C₅-C₆ intervertebral disc space. Scans were obtained in quiet breathing from lobule of the ear to the manubriosternal junction. Five millimeters thick sections were taken with additional 2 mm sections at the level of vocal cords. 2-D reconstruction in sagittal and coronal planes were done using computer assisted functions to see the extent of the tumour. The staging was done according to AJCC 1988 staging system.⁶

RESULTS

The present study comprises 20 patients, previously untreated and histopathologically proved squamous cell carcinoma of the larynx. All the patients were males with the mean age at presentation of 54 years. Thirteen patients (65%) were aged between 41-60 years. Fifteen patients (75%) were admitted within four months of the onset of the first symptom. Hoarseness 16/20 (80%) was the main presenting symptom, the other were stridor 7/20 (35%) and dysphagia 5/20 (25%).

Indirect and direct laryngoscopy revealed 11 tumours to be glottic (55%) and nine tumours to be supraglottic (45%) (Table 1 and 2). Table 3 shows the comparative clinical/CT staging of the tumour. A total of nine (45%) cases of carcinoma of the glottis were upstaged. One case of T₁ carcinoma of the glottis was upstaged to T₂ status; two cases of T₂ and six cases of T₃ carcinoma of the glottis were upstaged to T₄ status. At the supraglottic site, CT upstaging of the primary lesion was seen in four (20%) cases. One case of T₂ and T₃ each and both cases of T₂ status were upstaged to T₄ status. On clinical evaluation, only seven (35%) cases found to be staged correctly when compared with CT staging. All were squamous cell carcinoma of which 35% were well differentiated, 55% were moderately differentiated, while 10% were poorly differentiated.

Clinical examination of the cervical lymph nodes revealed two patients with N₂ status and one case with N₃ status. On CT staging, three cases were detected as having occult lymph nodes. The overall upstaging was observed in 13 cases (65%). Table 4 shows the various tumour invasions detected only on CT and were primarily responsible for the upstaging.

Table 1. Site wise distribution of the T-staging on direct laryngoscopy

Site	T ₁	T ₂	T ₃	T ₄	Total	%
Glottic	2	2	6	1	11	55
Supraglottic	2	2	1	4	9	45
Subglottic	0	0	0	0	0	0
Total no. of cases	4	4	7	5	20	100

Table 2. Site wise distribution of the nodal status

Site	T ₁	T ₂	T ₃	T ₄	Total	%
Glottic	10	1	0	0	11	55
Supraglottic	7	1	0	1	9	45
Subglottic	0	0	0	0	0	0
Total no. of cases	17	2	0	1	20	100

Table 3. Overall staging of the disease

Stage	Clinical staging		CT staging	
	N	%	N	%
I	3	15	1	5
II	4	20	0	0
III	7	35	1	5
IV	6	30	18	90
Total no. of patients				

Table 4. Invasions detected only on C.T.

	No. of cases	%
Preepiglottic space	4	20
Paralaryngeal space	10	50
Cartilage invasion	5	25
Lymph node involvement	3	15
Thyroarytenoid space	11	55
Pyriform sinus	7	35
Post cricoid region	3	15
Anterior commissure	5	25
Posterior commissure	3	15
Undersurface of true vocal cords	9	45
Extension to subglottic region	2	10

DISCUSSION

Almost all malignancies of the larynx are squamous cell carcinoma. In our study all the patients were male. A male preponderance has been reported in other studies.⁸⁻¹⁰ Our study revealed that 55% of the tumours were glottic, which is well documented in literature.⁹ The mean age of the patients was 54 years with 65% in the age group of 41-60 years. Hoarseness was the predominant symptom (80%). For many years, examination of the larynx was restricted to direct and indirect laryngoscopy, conventional tomography and laryngography.¹¹ With the development of better radiation therapy planning and conservative surgery techniques; precise delineation of tumour extent preoperatively by imaging studies and exact staging have become imperative for the appropriate therapeutic planning of laryngeal carcinoma.¹⁰

CT displays the larynx in a 3-D format allowing direct demonstration of tumour in both the larynx and paralaryngeal soft tissues as well as cartilages.¹² CT is more accurate than laryngography in determining superior and inferior limits of the tumour.¹³

In our study, CT upstaging of the carcinoma occurred in 13 (65%) cases. Twelve cases (60%), were upstaged to stage IV; 5% from stage I, 20% from stage II and 35% from stage III, while one (5%) case was upstaged from stage I to stage III. In 35% of cases, staging changed from T₃ to T₄; in 20% from T₂ to T₄ status and in 5% from T₂ to T₄. Charlin et al⁴ have also observed that CT was most useful in lesions initially classified as T₂ and T₃. Sulfaro et al found that CT has a high overall specificity i.e. 88.2% but a low sensitivity (47.1%).⁵

Clinical and endoscopic evaluation may fail to reveal cartilage invasion.¹⁵ In our study, cartilage involvement was seen in 25% cases, not detected clinically. Evidence of cartilage invasion is related to tumour size: lesions greater than 16 mm lying below the apex of the arytenoid have a high probability of cartilage invasion.¹⁶ CT may detect erosion of laryngeal cartilages when sufficiently extensive but microscopic extension cannot be detected.^{4,5,11,13} Tumour extension lateral to the arytenoid cartilage is difficult to assess by laryngoscopy but may be assessed by CT. Widening of the thyroarytenoid space indicates such an invasion^{10,11} and was seen in 55% of our cases (Fig.1). Curtin¹⁷ considered obliteration of fat within or widening of the thyroarytenoid gap on CT as involvement of the pyriform sinus apex.

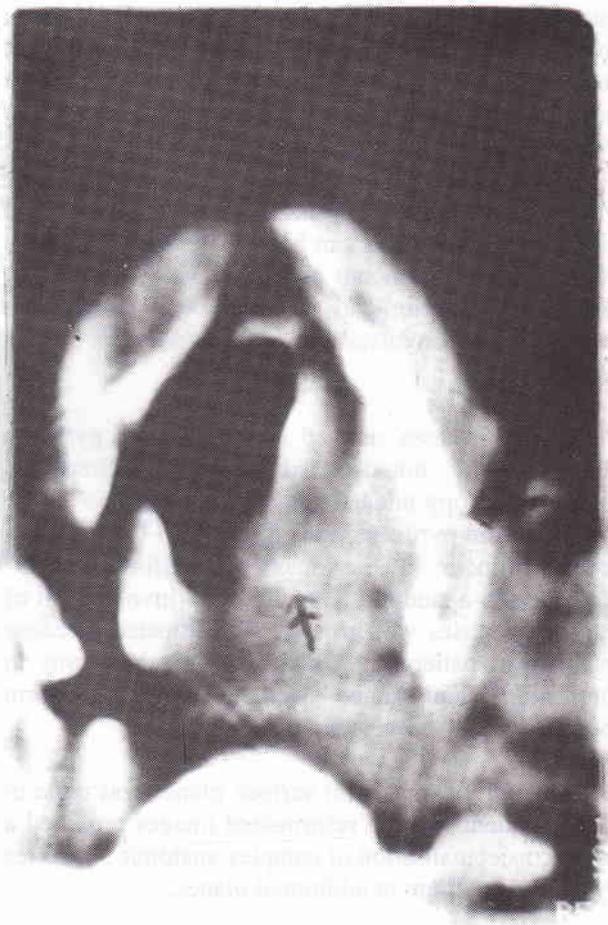


Figure 1. Axial CT (glottic level); growth involving the vocal cord, extension lateral to the arytenoid cartilage, medial displacement of the arytenoid and widened thyro-arytenoid distance. Notice there is also invasion of the thyroid cartilage.

In the present study, two cases (10%) with subglottic extension were missed clinically. Tumours arising between the true cords and lower border of cricoid are rare. Any soft tissue between cricoid cartilage and airway is abnormal and may represent subglottic tumour extension.¹⁸ Inferior extension can easily be assessed with either CT or MR imaging. However, MRI does afford the additional perspective of coronal sections.²

Involvement of preepiglottic space occurs with supraglottic tumours. The depth of tumour invasion is the most difficult to measure clinically.¹³ In our study, 45% were supraglottic tumours. In 20% cases, preepiglottic space involvement was not detected clinically, but was seen on CT. CT is more reliable for estimation of paraglottic space involvement, invasion

into the preepiglottic space and aryepiglottic fold.^{13,15,19} Detection of this type of invasion is vital for future therapy planning. Preepiglottic space does not contain lymph nodes, but does contain lymphatic channel that allow cervical metastasis.²⁰⁻²²

Tumour involvement of tissue deep to anterior and posterior commissures can be detected by CT if there is an increase in amount of tissue and/ or fixation of tissue. The anterior and posterior commissure were found to be involved in 25% and 15% cases respectively.

Seven (35%) cases showed involvement of pyriform sinuses on CT, not detected clinically. Indirect and direct endoscopy underestimated the extension of the tumour to the pyriform sinus apex while CT correctly reveals tumour at the apex of pyriform fossa.²³ However, in a study by Duggal et al,⁴ involvement of pyriform sinuses was grossly overestimated, because majority of patients had undergone tracheostomy in their study and hence, were unable to perform modified valsalva manoeuvre.

Reformation of images in various planes was done in all the patients. These reformatted images provided a better conceptualisation of complex anatomic structures by displaying them in additional planes.

We conclude that CT in laryngeal carcinoma, when used to determine tumour extent, has marked impact on accuracy of staging. This is best manifested in displaying deep tumor extension that cannot be seen during evaluation of mucosal surface by laryngoscopy/endoscopy.

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