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USE OF COMPUTED TOMOGRAPHY TO EVALUATE CARTILAGE INVASION IN PATIENT WITH CARCINOMA LARYNX

Radiodiagnosis

Dr. Nitin R Bhutada — Assistant Professor, Department Of Radiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India

Dr. Sunita N Bhutada* — Assistant Professor, Department Of Radiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India *Corresponding Author

ABSTRACT

AIMS & OBJECTIVES:-

1) To evaluate the sensitivity and specificity of detecting neoplastic cartilage invasion in laryngeal cancer patients with the use of spiral CT
2) To evaluate if CT findings influenced the management and treatment planning in patients with ca larynx

MATERIALS AND METHODS:- This is a prospective conducted at Tertiary care centre, from July 2016 to October 2018 involving 40 patients, in whom mass lesion is seen on indirect laryngoscope & FNAC/ Biopsy proves it to be a case of carcinoma larynx. Equipment used during study was-Siemens Dual slice Helical Somatom Emotion Duo CT scanner using multidetector CT with two slice spiral CT scanner, Somatom, Siemens (Germany)

RESULT :-

1) The CT can predict the cartilage invasion when combination of more than one criterion is used.
2) CT helped in changing the management in significant number of laryngeal cancer patients.

KEYWORDS

Laryngeal carcinoma, Cartilage invasion.

INTRODUCTION

Almost all malignancies of the larynx and hypo pharynx arise from the mucosal surface and thus are accessible to the direct visualization and biopsy. The radiologist is seldom the first to diagnose malignancy. However, the radiologist evaluates areas that the clinician cannot see: areas deep to the mucosa, or blocked by the bulk of the tumor. Imaging is usually not indicated in the lesion clinically staged at T1, although imaging is useful in differentiating stage T2 from higher stages. Failure to identify neoplastic involvement of the laryngeal cartilage may result in under staging of the tumor, which in turn affects the prognosis adversely.

AIM & OBJECTIVES:

1) To evaluate different diagnostic criterion to detect neoplastic cartilage invasion in laryngeal cancer patients with the use of spiral CT
2) To evaluate if CT findings influenced the management and treatment planning in patients with ca larynx

MATERIAL AND METHODS:

This prospective Hospital based study of evaluation of laryngeal mass using multidetector CT was carried out in the department of Radio diagnosis in a tertiary care institute. The study included 40 patients, in whom mass lesion is seen on indirect laryngoscope & FNAC/ Biopsy proves it to be a case of carcinoma larynx. Equipment used during study was-Siemens Dual slice Helical Somatom Emotion Duo CT scanner. All included patients were evaluated with detailed clinical history, physical examination and laboratory investigations where needed. All patients went through CT scanner with proper scanning technique and post processing image analysis. A meticulous follow up of all patients kept during study period. Histopathological confirmation was done where needed with all data entry into pre designed proforma.

For tumor staging, the TNM classification developed by American Joint Committee of Cancer in 2009 was used (8). T1 tumor is with tumor limited to one subsite of supraglottic or vocal cord or subglottic. When tumor is located to glottic and limited to one vocal cord it is staged as T1a. When tumor involves both vocal cords, it is staged as T1b. A tumor is staged T2 when supraglottic tumor invades mucosa of more than one adjacent subsite of supraglottic or region outside the supraglottic. The cases of glottic tumor extending to supraglottic and/or subglottic or subglottic tumor extending to vocal cords are also staged T2. T3 is staged tumor limited to larynx with vocal cord fixation. Invasion of tissue beyond the larynx is staged as T4. Tumor invading through the outer cortex invasion is classified as T4, whereas inner cortex invasion with intact outer cortex is classified as T3. Neoplastic infiltration of arytenoids does not affect the staging.

RESULT:

The *study was carried out in 40 patients comprising 38 (95%) males and 2 (5%) females. All the cases were above 44 years, with mean age of presentation 57 years.*

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Medullary space sclerosis - *This includes thickening of the outer or inner aspect of the cartilage, increased ossification of the medullary cavity, either partial or total & suggest neoplastic cartilage invasion and enables diagnosis of early perichondrium invasion or microscopic intra cartilaginous tumor spread. In our study sensitivities of, 72% in thyroid cartilage ,56% in cricoids cartilage and 41% in arytenoids cartilage were found. We observed that the overall sensitivity for sclerosis in all laryngeal cartilages was 58.82%*

Spiky surface - *This includes undulation, wave-like shaping or indention of the cartilage, that corresponds histologically with minor areas of chondrolysis or osteolysis. Specificities for spiky surface were 87.5% for thyroid cartilage, 86.36% for cricoid cartilage, and 96.49% for arytenoids cartilage. We observed that overall specificity of spiky surface was 92.23% respectively.*

Distorted framework :-*This sign is present when the alignment of the cartilage framework is distorted. Histologically it corresponds to erosion and destruction of bone due to osteoclastic activity. As a consequence, spiky surface and distorted framework can be considered specific criteria for the detection of neoplastic invasion in all laryngeal cartilages. Specificities for distorted framework or erosion were 90.4% for thyroid cartilage, 90.8% for cricoid cartilage, and 96.49% for arytenoids cartilage. The overall specificity of distorted framework was 94% respectively.*

Abnormal soft tissue on both sides of the cartilage :- *This is present when detectable tumor on the both sides of the cartilage is seen, corresponds to extra laryngeal spread of laryngeal carcinoma This CT criterion is highly specific, but because it is only seen very late in the disease process its sensitivity is low. Specificities for this sign which corresponds to extra laryngeal spread were 100% for thyroid cartilage, 86.36% for cricoid cartilage, and 94.74 for arytenoid cartilage. The overall specificity of abnormal soft tissue on both sides was 94% respectively.*

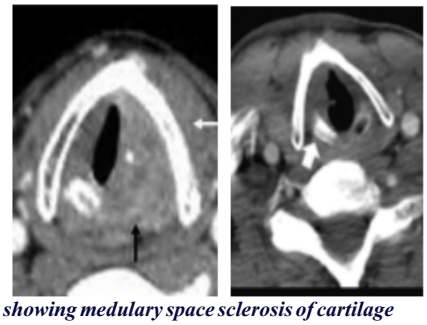


Figure 1 showing medulary space sclerosis of cartilage

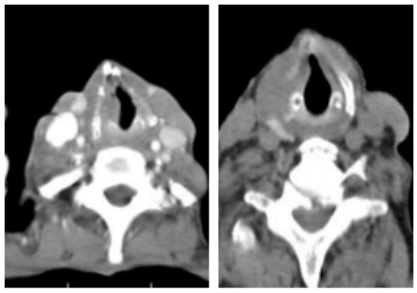


Figure 2 showing spiky surface of cartilage

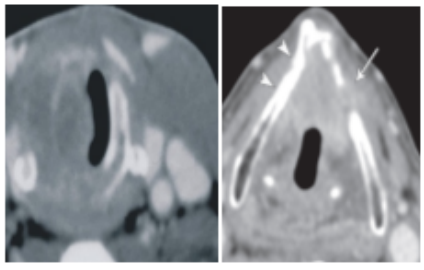


Figure 3 showing distorted framework of cartilage

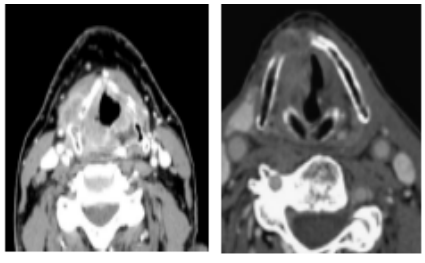
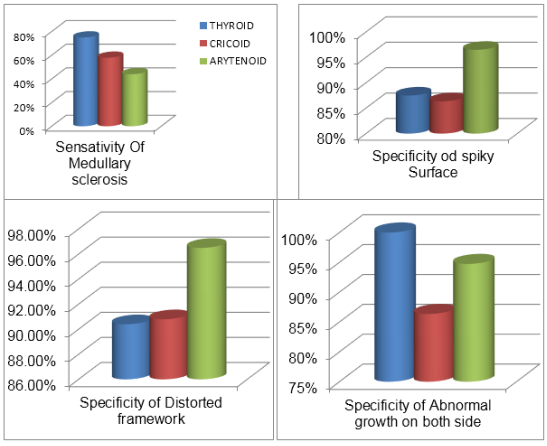
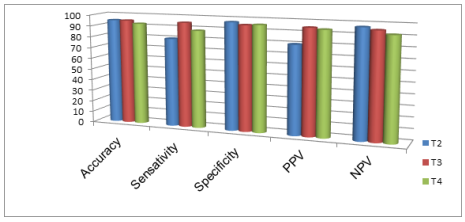


Figure 4 showing abnormal growth on both sides of cartilage

Depending on the diagnostic criteria and each specific cartilage, there was significant variation *in sensitivity (41%-83%) and specificity (49%-100%). Abnormal soft tissue on both sides of the cartilage yielded the highest specificity. But selection of appropriate combination of criteria leads to overall 95 % sensitivity and 97.3 % specificity.*



Bar graph 1 to 4 showing sensitivity & specificity criterion wise



Bar graph 5 showing sensitivity & specificity criterion combined

DISCUSSION :

The proper staging of laryngeal cancer requires accurate information about the invasion of the primary tumor to sub anatomical areas of larynx and cartilages. The usefulness of CT in the pre therapeutic staging of laryngeal cancer was emphasized in many cases, however, a few studies focused on involvement of sub anatomical areas of larynx. (2, 3, 7). Several studies in the literature describe that especially in the presence of extra laryngeal spread of tumor, CT can also visualize gross cartilage invasion, For early identification of cartilage invasion some authors have suggested new criteria to increase the sensitivity of CT procedures. In his studies with 111 cases of larynx cancer, Becker et al. (3,4)described four CT criteria (extra laryngeal spread, sclerosis, erosion and lysis) with high sensitivity and specificity for the identification of neoplastic cartilage invasion. In our study cartilage invasion was identified in 10 out of 85 cartilages. In histopathologically proven 3 cases, CT was unsuccessful in showing cricoids cartilage invasion. In ten cases, on the other hand, there were false positives on the CT. In our study, CT evaluation of the sclerotic cartilages that didn't have any evidence of histopathologically tumoral involvement revealed that the tumors in these cases were advanced as far as just by the side of the cartilage, without demonstrating any signs of cartilage invasion however. Since the finding of isolated cartilage sclerosis on CT may actually be a result of an ongoing reactive inflammation, it is possible to assume that the false positive assessment rates would increase when isolated cartilage sclerosis is used as the sole criterion for the cartilage involvement. Accurate assessment of preepiglottic and para glottic is mandatory for a correct staging, supraglottic tumors progress into T3 tumors if the PES and/or PGS is involved (3). The significance of paraglottic space lies especially in the determination of extension and accurate stage of transglottic cancers, because transglottic cancers invading paraglottic space have a high incidence of laryngeal skeleton invasion and cervical metastasis. The significance of preepiglottic space also lies in determination of surgical margins of the base of the tongue and whether the hyoid bone must be resected or not which are required in the supracricoid surgeries

Using histology as the gold standard, we determined that the CT when used combine criterion for cartilage invasion has a sensitivity of 95 %, specificity of 97 %, PPV of 80.8% and an NPV of 97.1 % for detection of invasion through cartilage.

Table 1 ***Clinical staging correlated with histopathology***

Stage	True positive	True negative	False negative	False positive	Accuracy
T2	4	30	0	6	85.00
T3	17	10	3	10	67.50
T4A	2	23	15	0	62.50

Table 2 ***CT staging correlated with histopathology***

Stage	True positive	True negative	False negative	False positive	Accuracy
T2	4	34	1	1	95.00
T3	19	20	0	1	97.50
T4A	15	23	2	0	95.50

Table 3 Accuracy of clinical & CT ***correlated with histopathology***

Staging	Clinical	CT	P-value	Inferance
T2	85	95	0.0260,	SIGNIFICANT
T3	67.5	97.50	0.0001	Highly SIGNIFICANT
T4A	62.5	95.50	0.0001	Highly SIGNIFICANT

Table 3 Comparison of current study with previous study.

Sr.No	Author	Number of patients	Year	Sensitivity	Specificity
1	Becker et al.	53	1995	66%	94%
2	Zbaren et al.	40	1996	67%	87%
3	Becker et al.	111	1997	61%	92%

4	Amilibia et al.	127	2001	54%	91%
5	Fernandes et al.	27	2006	86%	91%
6	S. Cagil et.al	30	2006	73%	81%
7	Current study	40	2017	95%	97%

We found, use of CT significantly correct the staging with more accuracy . Contribution of CT findings influenced the management and treatment planning in 17(42.5%) out of 40 patients with ca larynx Since multiple studies have shown great variation in PPV, NPV, sensitivity and specificity because of variable technical parameters or variable diagnostic criteria, the value of this technology is still somewhat uncertain

CONCLUSION:

1) The ability of CT to predict the cartilage invasion depends on the criteria used, with the use of spiral CT and combination of more than one criterion there is significant improvement in the usefulness of CT in predicting cartilage invasion.
2) Clinical/endoscopic evaluation fails to identify invasion of the laryngeal framework and of extra laryngeal soft tissues in a high percentage of cases; therefore many pT4 laryngeal tumors are clinically unrecognized.
3) CT helped delineate the precise spatial extent of the carcinoma of larynx by using Sagittal and Coronal MPRs.
4) CT helped in changing the management in significant number of laryngeal cancer patients sent for preoperative imaging, usually by depicting sub mucosal and deep extension, cartilage involvement, extra laryngeal spread, and nodal disease.

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