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Bronchogenic carcinoma: Correlation of CT findings with the surgical and histopathological findings

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Abstract
CT and HRCT how largely replaced radiological procedures such has bronchography and pulmonary angiography for evolution of parenchyma lung diseases. HRCT has enabled the delineation of lung parenchyma down to the level of secondary pulmonary lobule (Mayo R *et al.*, 1987). Further advancement in CT Technologies by spiral CT and ultra fast CT have still consolidated the role of CT in evolution thoracic diseases. Spiral CT facilitate generation of 3D images of lung that or not degraded by respiratory motion and is much faster at acquisition time ensuring evaluation of lung during maximum vascular enhancements. In this study CT evaluation of 50 patients with either proven or strongly suspected bronchogenic carcicnoma based on chest radiographs, bronchoscopy, cytology of bronchial washings or pleural fluid, FNAC or clinical examination was done. The most common cell type in bronchogenic carcinoma was squamous cell carcinoma in 33 patient (66%) followed by adenocarcinoma Majority of the adenocarcinoma cell type are presenting as central masses than peripheral (18% v/s 6%).

Keywords: bronchogenic carcinoma, CT findings, histo-pathological findings

Introduction
The invention of computed tomography by sir Godfrey Hounsefield in the early 1970's is considered to represent the greatest step in Radiology since the discovery of x ray. A description of the system and early clinical results were published in British journal of Radiology in 1973-74. Initially CT scan it was used for the diagnosis of intraacranial pathology only but later on it was realized that it is an important tool in assessing thoracic, abdominal and pelvic reasons also. Together with Allen Cormack, Hounsfield was awarded Nobel Prize in 1979 for his Revolutionary achievement [1].

CT and HRCT how largely replaced radiological procedures such has bronchography and pulmonary angiography for evolution of parenchyma lung diseases. HRCT has enabled the delineation of lung parenchyma down to the level of secondary pulmonary lobule (Mayo R *et al.*, 1987). Further advancement in CT Technologies by spiral CT and ultra fast CT have still consolidated the role of CT in evolution thoracic diseases. Spiral CT facilitate generation of 3D images of lung that or not degraded by respiratory motion and is much faster at acquisition time ensuring evaluation of lung during maximum vascular enhancements [2].

Ultra fast CT is fast enough to capture dynamic process with generation of images of 0.1-0.5 seconds. (Sten EJ *et al.* 1992). Fleischner FG *et al.* (1952) reported that if mediastinal lymph nodes became substantially enlarged the barium esophagogram may became abnormal especially in left paratracheal and sub carinal areas. O' Keefe *et al.* (1957) studied 72 patients with malignant solitary pulmonary nodule and found that 10 had calcification visible on radiography of the respected specimen [3].

Emami B, MeloA Cartar BL *et al.* (1978) studied the effectiveness of CT scanning in radiotherapuetic treatment planning in 32 patients with the bronchogenic carcinoma. CT the chest in pretreatment evolution of these patients supplemented conventional clinical and radiographic studies resulting in

1. More clearly delineation of tumor extent in 24 patients 75%
2. Change in assessment of the size of lesions in 14patients 43%
3. Change of diseases stages in 13 (40%)
4. Demonstration of inadequacy of treatment plan in nine (28%)
5. Changes in the volume of normal tissue a irradiated in 13 (40%). CT Scan data was

essential for treatment planning in 17 patients studied 53%. Unsuspected areas of tumor involvement was seen in 21 patients 65%

Faling L J *et al.* (1981) investigated the efficiency of the two seconds breath holding CT scans, standard P A lateral chest radiography in staging the mediastinal and pulmonary hila in lung cancer. The CT patients accurately predicted mediastinal lymphadenopathy in 15 of 17 patietns (sensitivity 88%). Specificity was also high 95%. Standard chest skiagrams were much less sensitive 47%, specificity were same. For hilar adenopathy sensitivity of both methods were same 67% Reisch sB *et al.* (1981) reported that conventional tomography including sections of helium in oblique projections, is effective in disclosing the hilar lymph node enlargement but much less so is assessing the mediastinal nodes [4].

Baron RL levitt RG *et al.* (1982) assessed 98 patients using CT scan whose diseases was later surgically staged. Prospective CT interpretation correctly diagnosed 33 of 35 (94%) resectable lesions and diseases in 41 of 45 patients (91%) who had lesions that were not resectable for cure. They also reported that retrospective analysis using slightly modified criteria result in a correct prediction of respectability in 28 of 30 patients (93%) and non respectability for cure 34 of 34 (100% patients).

Methodology

Selection of case

In this study CT evaluation of 50 patients with either proven or strongly suspected bronchogenic carcicnoma based on chest radiographs, bronchoscopy, cytology of bronchial washings or pleural fluid, FNAC or clinical examination was done.

Examination Procedure

Before commencing CT examination, all the preceding historical, clinical & laboratory data are recorded.

Computed Tomography Examination

Equipment

Somatom ART 3rd generation rotate-rotate type whole body CT scanner from Siemens.

C. T. Examination

CT scanning will be performed in two phase in the first phase, scans will be without contrast. In the second phase, scans will be obtained with non – ionic intravenous contrast. A bolus dose of 50ml of 60% iodinated non ionic contrast will be administered and scanning started immediately.

Technique

The technique will be to obtain a front view Topogram of thorax with the patient in supine position. Contiguous 10mm slices with 10 mm interslice gap covering the entire thorax, brain and upperabdomen, routinely includeng adrenals are taken. Scanning technique with 130 KVp and 70 mA will be used. For scanning the site of lesion, slice thickness of 5mm with interslice gap of 5mm will be used.

Parameters of evaluation will be detection of

- Nature of mass lesion - homogenous / hetrogenously enhancing
- Location of mass lesion
- Size of mass lesion.
- Margins of mass lesion.
- Lobes involved
- Presence of calcification and its pattern.
- Presence of cavitation.
- Presence of necrosis.
- Associated lung findings: adajcent collapse, consolidation, lymphangitic carcinomatosis, pulmonary tuberculosis etc.
- Presence of pleural effusion.
- Regional lymph adenopathy
- Mediastinal invasion (along with mediastinal pleura)
- Chest wall invasion with associated rib and destruction of vertebrae.
- Pericardial involvement.
- Abdominal metastases - liver, adrenal metastases.
- Intracranial metastases.
- Vascular Involvements

Results

Table 1: Distribution of cases According to TNM Staging

TNM staging	No of patients	percentage
T (Tumor)		
T1	2	4
T2	25	50
T3	3	6
T4	20	40
N (Nodes)		
No	36	72
N1	3	6
N2	8	16
N3	3	6
M (Metastases)		
Mo	39	78
M1	12	24

Most Of the Bronchogenic carcinomas detected were in T2Stage.

72% of patients Presented in No stage.

Distant Metastases were seen in 12 Patients (24%)

Table 2: Distribution of cases according to Stage at Diagnosis

Stage	No of patients	percentage
Stage 1	16	32
1A	1	2
1B	15	30
Stage 11	2	4
11 A	0	0
11B	2	4
Stage -3	20	40
3-A	2	4
3-B	18	36
Stage-4	12	24
Total	50	100

Most of the cases diagnosed as bronchogenic Carcinoma Were of Stage3 (40%)

Table 3: Distribution of cases according to pathology

S No	Tyoe of Bronchogenic Carionoma	No of patients	Percentage
1.	Squamous cell A Central in Location B. Peripheral	33 22 11	65 44 22
2.	Adeno Carcinoma A Central in Location B Periphral	12 9 3	24 18 6
3.	Small cell Carcinoma	2	4
4.	Large Cell Carcinoma	3	6
	Total	50	100

The most common cell type in bronchogenic carcinoma was squamous cell carcinoma in 33 patient (66%) followed by adenocarcinoma

Majority of the adenocarcinoma cell type are presenting as central masses than peripheral (18% v/s 6%)

Table 4: Distribution of cases According to Resectability

S. No.	Recetability	No of patients	Percentage
1	Resectable	18	36
2	Non Resectable	32	64

Majority of the patients presenting to us were not amenable to surgical resection.

Discussion

CT was also found useful in detecting presence of associated findings which are helpful in diagnosing and staging of carcinoma. Out of the 50 patients diagnosed as bronchogenic carcinoma in present study, pleural effusion was detected in 6 patients (12%) and pericardial effusion was found in 3 patients (6%).Vertebral erosion in 2 (4%), regional lymphadenopathy in 13 (26%), adjacent collapse/ consolidation in 11 (22%). lymphangitc carcinomatosa in 5 patients (10%).

Ina study done by Batra P *et al.* (1987) on 46 patients with known bronchogenic carcinoma similar incidences of intrathoracic invasion were found. They found pleural effusion in 7 patients (15.2%) mediastinal involvement in 30 (65%). rib metastasis in 6 (13%) and vertebral body involvement in 3 (6.5%) patients [5].

Mediastinal invasion was found in 18 patients (36%). All the patients showed the loss of fat plane between the mass and mediastinal pleura with area of contact being more than 3cm. These are similar to the criteria suggested by Glazar M *et al.* (1985). Loss of fat planes between mass and mediastinum was taken as criteria for mediastinal involvement.

Baron RI *et al.* (1982) found direct extension into mediastinum in 20% of patients which is slightly lower than present study. In present study, 13 patients (26%) showed vascular involvement. Out of 13 patients, 12 patients (24%) had SVC encasement/compression.

In present study, chest wall invasion was seen in 6 patients (12%), all showing involvement of ribs and/or upper thoracic vertebrae.

Lymphangitic carcinomatosa was seen in 5 patients (10%). On High resolution CT, typical appearance of nodular thickening of centrilobular bronchovascular bundles were seen (Munk P.L. *et al.* 1988) [6].

In present study, regional lymphadenopathy was detected in 13 patients (26%), with 3 patients in N1 Stage (6%), 8 patients. N2 stage (16%) and 3 patients in N3 stage (6%). The criteria for lymph node involvement used was lymph node size >10mm in shortest axis. In 37 patients (74%) no regional lymphadenopathy was seen.

Whittlesey D *et al.* (1988) reported prevalence of N0 disease as 79% for all CT calcification. In the present study prevalence of N0 disease was found in 72%.

Pulmonary metastasis was noted in 6 patients (12%). This is in accordance with incidence range 7 to 50% reported in various studies (Fraser, 1989).

Abdominal metastases was diagnosed in 8 patients (16 %). 5 patients had metastasis in liver, 1 in adrenal, 2 patients had metastasis in both liver and adrenal. Adrenal metastasis was seen in as enlargement of adrenal glands. Metastasis in low liver weight seen as hypodense lesion showing minimal contrast enhancement in post contrast scans. Hepatic and adrenal involvement was more common than at adrenal involvement.

Michael A Sandler (1982) found that only 5% of patients had isolated adrenal metastasis in their study of 100 patients.

Intracranial metastasis was diagnosed in 6 patients (12%). In accordance with our study Minitz BJ at all (1983) also reported evidence of intracranial metastasis in 12% patients in thier study.

Abdominal metastases marginally more common than intracranial metastasis. In present study all the patients diagnosed as bronchogenic carcinoma were staged by TNM criteria. 25 patients were in T2 (50%), 3 patients in T3 (6%) and 20 patients in T4 (40%); only two patients were in T1 (4%). This is because most of the patients referred to CT study late in their course. In all stages visualization and delineation of mass was satisfactory on CT Scan. After staging, 16 patients were in stage I (32%), 2 patients in stage II (4%), 19 patients in stage III (38%) and 12 patients in stage IV (24%). Staging the patient was accurate in most of the cases with clear visualization of the mass, intrathoracic extent, lymphadenopathy and distant metastasis, thus enabling further management of patients including decision about resectability and radiotherapy planning [7, 8].

In a study done by Ferguson *et al.* (1986) in 61 patients of the proven bronchogenic carcinoma 16 patients (26%) had stage I, 8 had stage II (13%), 37 had stage III disease (60%).

In contradiction to our study Christopher S Koutulosa, Christopher N *et al.* (2004) reported that in the study 557 patients with proven bronchogenic carcinoma 52 in stage 1A, 109 in IB, 20 in II A, 146 in II B,190 into IIIA,35 in III B and 5 in IV Stage [9].

In present study majority of cases were unresectable (72% versus 28%). This is because most of the patients presented in stage 3 and stage 4 (31 out of 50).

The most common cell type of bronchogenic carcinoma was squamous cell carcinoma in 33 patients (66%) followed by

adenocarcinoma (24%).

In accordance with our study Christophers S Koutolosa *et al.* (2003) reported that 557 patients with non small cell bronchogenic carcinoma 220 where adenocarcinoma 276 were sqaumous cell carcinoma [10].

Conclusion

CT can be used an imaging modality for definitely diagnosing and accurately staging almost all cases of bronchogenic carcinoma thus helping greatly in management of the patient and improving the final outcome.

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