



SOLITARY PULMONARY NODULE: EVALUATION ON CT

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ABSTRACT The role of CT in diagnosis and management of solitary pulmonary nodule (SPN) is evaluated and the literature reviewed. 33 cases of SPN were studied. CT value of all malignant nodules was less than 150 HU except in one case. 8 out of 12 benign nodules had CT value more than 150 HU. Significance and limitation of evaluation of density values in pulmonary nodules are discussed.

KEYWORDS :**Introduction**

An SPN is a circumscribed round or ovoid opacity surrounded by aerated lung, detected on routine chest X-ray, more often by chance rather than by choice. The discovery of a nodular lesion on chest radiography causes a great deal of concern. 30% of bronchogenic carcinomas present as pulmonary nodules and are often asymptomatic. Two dependable radiographic findings, which exclude malignancy, are absence of increase in size over 12-24 months and presence of central, diffuse, stippled or concentric calcification which is rare in primary cancer of the lung, and if present is usually eccentric [6].

The purpose of this study is to evaluate the usefulness of CT in the diagnosis and management of SPN with special emphasis on tissue differentiation and contrast enhancement, in addition to localization, study of morphology and detection of hidden lesions of mediastinum.

Material and methods

Thirty-three cases of SPN detected on routine chest X-ray were referred for CT. 27 were males and 6 were females. Their ages ranged from 17 to 89 years. 4 mm axial sections from above the bifurcation of trachea to the lower limit of both hilar regions and at the level of pulmonary nodule were taken the rest of the chest was studied with 8mm thickness sections. This was followed by 2 mm sections of the pulmonary nodule. The CT density was estimated in terms of Hounsfield value by an average of 5 to 10 readups in the region of the nodule.

In 13 cases the study of the nodule was repeated after administration of intravenous iodinated contrast of which 2 cases were studied by dynamic CT. Time density curve was plotted in cases where dynamic study was performed.

Results

The involvement of males was more than females (27:6). The SPN involved the right hemithorax in 17 cases and left hemithorax in 16 cases. Out of 33 pulmonary nodules studied, 21 were malignant and 12 were benign (Table 1). All malignant nodules had CT value less than 150 HU except one case in which average CT value was 250 HU, i.e. high CT value. In the majority of malignant nodules (13 out of 21), the CT value was between 40 and 60 HU (Table 2); 18 out of 21 malignant nodules on resection were primary bronchogenic carcinoma and 3 were metastatic tumours, with primary detected elsewhere on evaluation.

TABLE 1: SHOWING SEX DISTRIBUTION AND NATURE OF SPN

Sex	Benign Nodule	Malignant Nodule	Total
Male	8	19	27
Female	4	2	6
Total	12	21	33

TABLE 2: SHOWING CT VALUE IN RELATION TO NATURE OF SPN

CT Value in HU	Benign Nodule	Malignant Nodule
-200 to 25	1	-
25 to 40	-	5
40 to 60	3	13
60 to 150	-	2
150 to above	8	1
Total	12	21

Eight out of 12 benign nodules had CT value more than 150 HU which on biopsy or resection were found to be one case each of hamartoma and bronchial adenoma and 6 cases of granuloma (tuberculous). In 4 benign lesions, the CT value was less than 150 HU of which one was lipoma, 2 nodules were of vascular origin and one intrapulmonary lymph node. The diagnosis of lipoma was made on its negative CT value {(-)120 to (-)200 HU}.

In 13 out of 24 SPN which had CT value less than 150 HU, scanning in the region of the nodules was repeated after administration of intravenous contrast; 11 cases showed no preferential enhancement, i.e. CT value after contrast increased by 10-20 HU. 2 cases demonstrated preferential uptake of contrast, i.e. CT value after contrast administration increased by 40-60 HU. These 2 cases on dynamic CT, followed by plotting of time density curve with reconstruction and horizontal profile, were diagnosed as arteriovenous malformations.

Discussion

CT is an established tool for evaluating pulmonary masses [4]. SPN has always posed a clinical problem. We tried to evaluate the role of CT in predicting the nature of the nodule. In This study we found that all malignant nodules had CT value less than 150 HU, except one case in which CT value was very high. In 163 out 21 malignant nodules CT value was between 40 and 60 HU.

Majority of benign nodules, i.e. 8 out of 12 had CT value more than 150 HU (Table 2). The benign nodules which had low CT value were one case each of lipoma and intra-pulmonary lymph node and 2 cases of arteriovenous malformation. Lipoma presents as a nodule with negative CT value. It is one of the few conditions in which CT offers a definitive diagnosis.

SPN on CT may show more than one nodule lying in close association. CT may also show hilar and mediastinal adenopathy which helps in staging of cancer, determining resectability, for planning treatment and establishing prognosis [7].

Sigelman *et al* [8] used CT to assess pulmonary nodule density in 91 apparently uncalcified nodules. None of the 58 malignant nodules, either primary or secondary malignancy, had CT value greater than 147 HU with an average representation of 92 HU. 20 of 33 benign lesions had representative number greater than 164 HU and none of these was calcified on conventional chest films or tomograms. They concluded

that CT identified more benign nodules than conventional radiography, and that a nodule with a representative CT number greater than 150 HU need not be resected. Such a lesion could be re-examined at 2 to 3 months intervals by conventional radiographs and watch for change in size. CT densitometry could avert an invasive diagnostic procedure and provide a more objective, more sensitive assessment of calcification than could conventional radiography. High CT density in benign nodules was attributed to diffuse microscope calcification and possibly fibrosis.

Godwin *et al* [1] attempted to confirm these findings in a study of 36 pulmonary nodules (14 malignant and 22 benign). Although some benign nodules had distinctly higher attenuation value than malignant lesions, CT identified only one additional nodule over those found to be calcified on plain radiograph or conventional tomograms. 16 out of 22 benign lesions had CT value less than 165 HU and could not be distinguished from malignant nodules, suggesting that CT was not significantly more useful than conventional radiography and tomography in distinguishing benign from malignant nodules; hence CT densitometry remains a controversial subject in distinguishing benign from malignant pulmonary nodules.

Goldstein *et al* [2] and Stewart [9] reported a case each of calcified adenocarcinoma of the lung with very high CT value. Stewart [9] also reported a poorly differentiated squamous carcinoma with maximum CT value of 240 HU. Scar carcinomas associated with prior lung disease leading to fibrosis are likely to have high CT value. Thus high CT value or calcification is not histo-specific sign of benignancy. However, very large majorities of SPN having high CT value are benign [1, 7]. This has also been observed in the present study; hence, patients with SPN having CT value more than 150 HU may be observed with serial X-rays for any signs of growth; but if level of clinical suspicion for malignancy is high regardless of nodule's morphology or patient's age, it should be subjected to biopsy or thoractomy.

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