Original Research Article

Assessment of high resolution computed tomography in the diagnosis of interstitial lung disease

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ABSTRACT

Background: Interstitial lung disease (ILD) are group of pulmonary disorders characterized by inflammation and fibrosis of gas exchanging portion of the lung and diffuse abnormalities on lung radiograph. Conventional computerized tomography plays a limited role in evaluation of interstitial lung disease due to its inability to demonstrate fine parenchymal details. High Resolution Computed Tomography (HRCT) is currently the most accurate non invasive modality for evaluating lung parenchyma. So, the purpose of the study was to assess high resolution computed tomography in the diagnosis of interstitial lung disease.

Methods: 50 patients with clinical suspicion of interstitial lung disease who were referred to Department of Radio-Diagnosis and Imaging for diagnosis and evaluation were subjected to both conventional radiography and HRCT.

Results: Majority of the cases i.e. 9 (18%) had honeycombing, 8 (16%) cases had crazy paving pattern and mosaic attenuation, 7 (14%) cases had miliary mottling, 6 (12%) cases had normal, 5 (10%) cases had fibrosis and ground glass haze, 2 (4%) cases had ground glass haze with Intralobular reticular opacities and 2 (4%), subpleural nodular opacities and 2 (4%) cases had B/Hilar lymphadenopathy.

Conclusions: Ultimately all patients with clinical suspicion of ILDs should benefit from an HRCT scan of the thorax. High resolution computed tomography (HRCT) chest scans are essential to the diagnostic work-up since each ILD form is characterized by a specific pattern of abnormalities and a confident diagnosis can often be arrived at by HRCT alone or in correlation with the clinical symptoms. When HRCT findings are characteristic in appropriate clinical settings, HRCT may even obviate the need for a lung biopsy.

Keywords: Diagnosis, Interstitial lung disease, High resolution computed tomography

INTRODUCTION

Interstitial lung disease (ILD) are group of pulmonary disorders characterized by inflammation and fibrosis of gas exchanging portion of the lung and diffuse abnormalities on lung radiograph.

Conventional plain film radiography remains the first and foremost imaging modality used in initial assessment and follow up evaluation of virtually all patients. However, a normal chest radiograph does not exclude the presence of interstitial lung disease.¹,² Approximately 4% of patients with dyspnea had normal chest radiograph are limited in sensitivity, specificity and diagnostic accuracy.³ Conventional computerized tomography plays a limited role in evaluation of interstitial lung disease due to its inability to demonstrate fine parenchymal details .First introduced in 1982 High Resolution Computed Tomography (HRCT) is currently the most accurate non invasive modality for evaluating lung parenchyma.⁴,⁵ HRCT findings in patients with ILD include thickened
interlobular septa, reticular, nodular or ground glass area of attenuation, subpleural lines, architectural distortion, and honeycombing. The other uses of HRCT in ILD besides detection and characterization included detecting co-existing diseases, detecting and assessment of complications, providing a guide to the type and site of lung biopsy, follow-up for evaluation for response to therapy.\textsuperscript{7,8}

The findings. Diagnosis of disease includes at the interlobular septa and parenchymal interstitium which is a potential space interposed between the basement membrane of the alveolar lining epithelium and capillary endothelium.\textsuperscript{9,10} So the purpose of the study was to assess high resolution computed tomography in the diagnosis of interstitial lung disease.

METHODS

The study was conducted during a period from July 2012 to September 2014 with a sample size of 50 cases which were collected over a period of 2 years all the scans were performed on the high speed dual scan CT by GE and included non enhanced axial scans with 1 mm collimation at the scan interval of 10 mm in suspended inspiration with patient in supine position.

All the patients with clinical suspicion of Interstitial Lung Disease who were referred to Department of Radiodiagnosis and Imaging for diagnosis and evaluation were subjected to both conventional radiography and HRCT. Standard postero-anterior view was taken in all cases. Diagnosis was based on clinical and radiological findings.

The exposure factors used were kVp 140; mA 130-240; mAs 240-400 and a scan time of 2-3 seconds. The Field of View (FOV) matched to the patients size (30-40cms). The Lung window consistently used for scanning was 700 to -800HU. The exact technique was however altered according to the individual.

The important factors making it “High Resolution” are use of thin collimation, image reconstruction with high spatial (sharp) algorithm, increased kVp and mAs technique, the use of large matrix size and targeted image reconstruction

Scan was done with 1 cm collimation. Volume averaging within the plane of the scan significantly reduces the ability of CT to resolve small structures. Scanning with the thinnest possible collimation is essential if spatial resolution is to be optimized therefore 1 mm collimation was used. High resolution techniques in addition to increasing image sharpness also increases the noise in CT images. Thus, increasing the kVp, mA, or the scan time can reduce noise and improve image quality.

RESULTS

The Table 1 shows HRCT finding wise distribution among 50 cases in study group. Majority of the cases i.e. 9 (18%) had honeycombing, 8 (16%) cases had crazy paving pattern and mosaic attenuation, 7 (14%) cases had miliary motting, 2 (4%) cases were normal, 5 (10%) cases had fibrosis and ground glass haze, 2 (4%) cases had ground glass haze with intralobular reticular opacities and 2(4%), Subpleural nodular opacities and 2(4%) cases had B/Hilar lymphadenopathy.

Table 1: HRCT finding wise distribution of cases in study group.

<table>
<thead>
<tr>
<th>HRCT finding</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/Hilar Lymphadenopathy</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Crazy paving pattern</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Ground glass haze</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Miliary motting</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Honeycombing</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Mosaic attenuation</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Ground glass haze + Reticular</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>opacities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subpleural Nodular Opacities</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Normal</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: HRCT diagnosis wise distribution of cases in study group.

<table>
<thead>
<tr>
<th>HRCT diagnosis</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIP/IPF</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>BOOP</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>NSIP</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Hypersensitivity Pneumonitis</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Miliary TB</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Lymphangitis carcinomatsa</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DIP</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Asbestosis</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Normal</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
The Table 2 shows HRCT finding wise distribution among 50 cases in study group. Majority of the cases i.e. 13 (26%) had usual interstitial pneumonia (UIP) and idiopathic pulmonary fibrosis (IPF), 8 (16%) cases had bronchiolitis obliterans organizing pneumonia (BOOP), 6 (12%) cases had hypersensitive pneumonitis, 7 (14%) cases had miliary Koch’s, 5 (10%) cases had nonspecific interstitial pneumonia (NSIP), 2 (4%) cases had desquamative interstitial pneumonia (DIP), 2 (4%) cases had asbestosis and 2 (4%) cases had sarcoidosis and lymphangitis carcinomatosa, 1 (2%) cases had fibrosis and 6 (12%) normal.

DISCUSSION

Interstitial lung disease (ILD) are group of pulmonary disorders characterized by inflammation and fibrosis of gas exchanging portion of the lung and diffuse abnormalities on lung radiograph. The diseases currently grouped as “interstitial” also involves the alveolar epithelium, alveolar space, pulmonary vasculature and less commonly the respiratory bronchioles, large airways and even pleura.11,12 The most common type of interstitial lung disease in our study was usual interstitial lung disease.

HRCT finding wise distribution 4% showed bilateral hilar lymphadenopathy, 16% had crazy paving pattern, 10% had fibrosis and ground glass pattern, 14% had miliary mottling, 18% had honeycomb, 16% had mosaic attenuation. Rest 12% had normal HRCT finding (Table 5). HRCT scan diagnosis showed that 26% cases had UIP/IPF, 16% cases had BOO, 14% had miliary TB, 12% had hypersensitive pneumonitis, 10% had NSIP, 4% had sarcoidosis and lymphangitis carcinomatosa and 2% had fibrosis.14-16 10% cases had normal HRCT scan finding. Muhammad SK et al, assessed the ability of high resolution computed tomography (HRCT) in detecting the early signs of pulmonary involvement in patients with systemic sclerosis. The HCRT findings were distributed among the reticular and nodular structures (70%), decreased attenuation (70%) and other accompanying lesions seen in (60%) of patients. Present study showed that reticulo-nodular opacities are seen in 36% of cases which include honeycombting and miliarymottling.17,18

Decreased opacity is seen in 38% of cases which include Emphysema and Mosaic attenuation. However, areas of Architectural distortion is seen in only 5% of the cases.19

Muhammed Shafeeq K et al, determined the clinical and radiological profile and etiology of ILD patients in a tertiary care setting. Exertional dyspnoea was the commonest presenting symptom (97.2%) followed by cough (90%). Commonest HRCT pattern was UIP (42%) followed by NSIP (24%). Connective tissue disease work up was positive in 29% of the study population. Commonest type of ILD was IPF (38.6%) followed by connective tissue associated ILD (24.2%). The findings in our study matched with their study.58 Detecting interstitial lung disease by HRCT and X ray showed sensitivity of 77.27% and specificity of 33.33%. Positive predictive value of detecting interstitial lung disease was 89.47% and negative predictive value is 16.67%. The main observation in our study was that higher number of samples with findings were detected by HRCT as compared to conventional radiography. Even when both modalities were able to detect the findings, HRCT could characterize the abnormality and specify its location much more accurately. Ranigaet S et al, evaluated the Interstitial Lung Disease (ILD) in the patients with Rheumatoid Arthritis (RA). This study was conducted to evaluate the clinico-spirometric profile and High Resolution Computed Tomography (HRCT) findings with regards to early detection of possible lung involvement in the study group. Authors concluded that HRCT was superior to plain chest radiograph in the evaluation of early interstitial lung changes. Our studies resembled their study.20,21

Kornum JB et al, examined incidence rates (IRs) of ILDs and changes in IRs between 1995 and 2005. The median age of the 12,639 (58%) men was 63 years and that of the 9,126 (42%) women was 64 years.22

Association between symptoms and interstitial lung diseases showed cases who had Tuberculosis were significantly more associated with interstitial lung diseases as compared to those who smoke, history of occupational exposure and history of cough and fever (Table 9). Fathi M et al, estimated the prevalence and predictors of interstitial lung disease in newly diagnosed polymyositis and dermatomyositis. Interstitial lung disease (ILD), defined as radiological signs on chest X-ray examination/HRCT or restrictive ventilatory defect, were found in 11 (65%) patients and were more common in men than in women. There was no statistically significant association between respiratory symptoms, other serological or laboratory variables and ILD which was similar to our study finding.23,24

The diagnosis of interstitial lung disease (ILD) is frequently delayed because clinical clues are neglected and respiratory symptoms are described to more common pulmonary diagnosis such as chronic obstructive pulmonary disease (COPD) in the primary care setting. While ILD cases ultimately require referral to a pulmonologist, many cases can be diagnosed in the early stages with the help of HRCT.25-27 HRCT is able to detect abnormalities in patients when the clinical signs are minimal or even when the chest radiograph appears completely normal.

Chest radiography is a relatively insensitive modality for investigation for the diagnosis of ILDs. Ultimately all patients with clinical suspicion of ILDs should benefit from an HRCT scan of the thorax. High resolution computed tomography (HRCT) chest scans are essential to the diagnostic work-up since each ILD form is characterized by a specific pattern of abnormalities and a
confident diagnosis can often be arrived at by HRCT alone or in correlation with the clinical symptoms. When HRCT findings are characteristic in appropriate clinical settings, HRCT may even obviate the need for a lung biopsy.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

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Rheumatoid arthritis (Ra)-a study of thirty cases. Indian J Radiology Imaging. 2006 Oct 1;16(4):835.
