EDITORIAL

# Understanding HRCT of the Lungs

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High-Resolution Computerized Tomography (HRCT) of the lung is now a well-established and widely used technique in the management of respiratory disease. It is the only imaging technique currently available that allows the *in vivo* visualization of the secondary pulmonary lobule.[1] This unique ability has enabled HRCT to revolutionize not only the diagnosis, but also the understanding of interstitial lung disease.

The technique is relatively simple to implement. Virtually any CT scanner, of any age, is capable of performing a basic HRCT of the lung. Attention to detail is important. The minimum standards have been set out by a number of professional organizations. The most widely used are the American College of Radiology guidelines.[2] The basic technique involves obtaining very thin (1-2 mm) axial sections of the chest. The sections are spaced 10-15 mm apart. In this way, approximately 20-25 percent of the lung is sampled. The sections are processed using a sharp or 'bone' algorithm to enhance the detection of edges. The images are viewed on suitable lung windows (Level -500 to -750, width 1000 to 1500). Although the exact windowing is not important, it is important to standardize the values for a particular institution. The same window setting used each time a HRCT is performed make evaluation of serial examinations much more effective as subtle changes in lung attenuation are not lost in the technical factors. Another important factor to note is that administration of intravenous contrast also changes lung parenchymal attenuation. Contrast should not be given for HRCT examinations. If the patient requires both i.e. a HRCT as well as a contrast enhanced scan, the HRCT should be performed first. The initial description of HRCT was for axial images only. These axial images remain the mainstay of the test, however, recent studies on multi-detector row CT (MDCT) has shown a role for reformatting and viewing the scan in coronal and saggital modes.[3]

The indications for the HRCT of the lung are well-established.[4] These include all the diffuse lung diseases such as idiopathic interstitial pneumonia, emphysema etc. HRCT is also used to investigate respiratory symptoms when the chest X-rays are normal. In a country like Pakistan, where tuberculosis is endemic, another important indication of HRCT is differentiation between TB and other causes of interstitial infiltration and nodules.

The HRCT should not be interpreted in isolation. The consideration of the clinical history and comparison with any previous imaging is essential. HRCT, interpreted in context, has an increased chance of resulting in a histo-specific diagnosis.[5] Appropriate interpretation also requires both knowledge and understanding of the anatomy as demonstrated on the HRCT. This understanding allows the pathological processes to be accurately placed in the appropriate anatomical compartments, facilitating an appropriate differential diagnosis.[6,7]

The nomenclature for interstitial lung diseases is confusing. Cryptogenic Fibrosing Alveolitis (CFA), Idiopathic Pulmonary Fibrosis (IPF) and the Usual Interstitial Pneumonitis (UIP), all refer to the same disease entity. To address this and other issues related to interstitial lung diseases, the American Thoracic Society and the European Respiratory Society published a consensus statement on their classification.[8] This statement clearly sets out the diagnostic criteria (clinical, radiological and pathological) for the diagnosis of the Idiopathic Interstitial Pneumonias (IIP). It also simplifies the job of the radiologist. Under the new classification, when Diffuse Parenchymal Lung Diseases (DPLD) of known causes such as drugs and well re-established and distinct entities such as Lymphangiomyomatosis (LAM) are set aside, the essential differential diagnosis is between granulomatous DPLDs (e.g. sarcoidosis, TB) and the other IIPs. Further among the IIPs, the differentiation is between IPF (which usually does not respond well to treatment) and all other IIPs (which are usually responsive to steroid and other immune modulating therapies).

One recurring dilemma in the practice of respiratory medicine in Pakistan is the differentiation of tuberculosis from other causes of lung diseases. TB is a great mimicker and has a myriad of clinical and radiological presentations. The transbronchial dissemination of TB with lymphatic and perilymphatic involvement of the

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lung interstitium is sometimes difficult to distinguish from other causes of interstitial abnormalities as demonstrated on plain chest X-rays. HRCT plays a vital role in differentiating granulomatous processes from other DPLDs.[1,7] Although the features of TB such as centrilobular nodularity and 'tree in bud" appearances are not pathognomonic, they are distinctive enough to strongly suggest TB.[9,10] Presence of lymphadenopathy (calcified or otherwise), consolidation, cavitation and the presence of pleural effusion are also helpful.[11]

Good as HRCT is at depicting lung pathology, it has its limitations. As the technique calls for 1-2 mm slice thickness, it only samples 20-25% of the chest, therefore, HRCT is not suitable for focal diseases such as lung cancer. This limitation has partially been addressed by the introduction of volume imaging allowing contiguous slices to be acquired ensuring coverage of the entire chest. The other limitation is the large overlap in the appearances of the various entities leading to abnormalities of the lung interstitium. Although the sensitivity of HRCT to detect interstitial lung disease is approximately 94%,[4] its ability to make a histo-specific diagnosis is significantly less than this. The likelihood of making a correct diagnosis on HRCT depends on the pre-test probability of the specific disease being present in the patient. Some diseases (e.g. Idiopathic pulmonary fibrosis, lymphangitis carcinomatosis, sarcoidosis, Langerhan's cell histiocytosis, lymphangiomyomatosis, sub-acute hypersensitivity pneumonitis) have characteristic appearances allowing experienced observers to reach a correct diagnosis in the majority of cases,[12] there is a significant convergence in appearances between interstitial lung diseases when taken as a group. The reported accuracy of making a histologically accurate diagnosis varies from 61% to 93%.[4] The higher figures being from the earlier studies when perhaps there was a lack of a fuller appreciation of the complexities of the HRCT appearances.

HRCT in good hands is likely to yield very useful information regarding the diffuse parenchymal lung disease. Its value in correctly identifying disseminated pulmonary tuberculosis is of particular importance in this setting. Attention to detail in obtaining the images and care in their interpretation is vital.

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