

LTRC Concept Sheet # 07-05-0002

Correlation of Pulmonary CT Semi-Quantitative and Quantitative Parenchymal Measures obtained with two different techniques with histologic subtype of interstitial pneumonia and with physiologic data in these patients.

ABSTRACT

The purpose of the Lung Tissue Research Consortium (LTRC) is to enable better characterization and management of lung diseases by increasing understanding of idiopathic interstitial pneumonias (IIP's) through creation of a repository containing in-depth clinical data, radiological data and tissue samples. It is hoped that the understanding of the pathogenetic mechanisms of disease can be increased by through studies that utilize this data.

The Mayo Clinic Rochester serves as the Radiology Core Laboratory (RCL) for the LTRC, where radiological data from the patients enrolled in the LTRC project are interpreted, stored and processed. Part of the analysis of the RCL includes characterization of the lung tissue on volumetric high-resolution CT scans through histogram and texture-based measures of the CT image data. The RCL goal is to show a relationship between these mathematical image features with specific visual features and overall extent of pulmonary involvement by comparison with physiologic parameters and specific proven diagnoses. To achieve this goal, correlation of the measures performed by the RCL with the radiologist interpretation, pulmonary function data, pathological and clinical diagnoses stored within the LTRC repository is needed.

Our laboratory has produced software for the 3-dimensional texture analysis, histogram measurement and airway characteristics quantification of volumetric high-resolution CT data. Preliminary data from our laboratory suggests that quantitative and mathematical measures of volumetric high-resolution chest CT data correspond to specific visual features of disease. Since the extent of these visual features generally correlates with the overall extent of disease, we predict that the quantitative measures will also show a relationship with changes in physiologic data and histological and clinical diagnoses. Even 'gold standard' pulmonary function data is highly influenced by patient effort and subtle changes in extent of pulmonary involvement are difficult to visually assess. Similarly, repetitive lung tissue sampling to assess pathological changes is invasive and potentially harmful. Therefore, it is hoped that quantitative assessment by analysis of volumetric CT can provide an automated non-invasive measure that can be used as a tool for objective assessment of disease extent, progression or response to therapy. This could potentially have large clinical utility.

A second quantitative approach to HRCT images, the Adaptive Multiple Feature Method (AMFM), is a complex texture-based method for characterizing lung parenchyma developed by Eric Hoffman, PhD and colleagues at the University of Iowa. Published data highlight that this methodology can recognize features such as honeycombing, ground glass, bronchovascular bundles, nodules, emphysema, and normal and disease states such as sarcoid, usual interstitial pneumonitis/idiopathic pulmonary fibrosis (UIP/IPF), normal, and emphysema. An active collaboration between the University of Michigan and the University of Iowa is ongoing to determine the role of such a technique in quantifying abnormality in patients with a diffuse parenchymal lung disorder. Analysis of the CT scan data in the LTRC repository by investigators using the AMFM method will allow a comparison between the AMFM method and the quantitative approach utilized by the LTRC RCL. The CT scan data for subjects that were evaluated with the LTRC Full Three Phase CT Protocol will be processed by the AMFM method and results of this will be submitted for statistical analysis and comparison to the LTRC RCL methods.