**High resolution CT-based characterization analysis of idiopathic pulmonary fibrosis**

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Also need to include Auckland City Hospital collabarators who provided the IPF data (any funding?)

**Introduction**

Idiopathic pulmonary fibrosis (IPF) is the most aggressive and frequently form of idiopathic interstitial pneumonias. It is a chronic and life-threatening disease of unknown cause, and occurs primarily in middle-aged and elderly adults. Progression of IPF is variable between individuals and unpredictable with few tissue-level biomarkers for progression identified. We propose a CT based classification analysis of IPF lung disease as a step toward a robust and consistent IPF assessment and diagnosis system. We aim to analyze and characterize IPF tissue abnormalities over time using quantitative methods.

**Method**

Tissue regions in HRCT images from 8 patients with IPF were quantitatively analysed and compared with 30 normal elderly subjects. IPF tissue was classified using CALIPER (Computer-Aided Lung Informatics for Pathology Evaluation and Ratings) software. The classified data were mapped to a statistical shape model, which allows consistent comparison between different patients or within one patient over time. Tissue density, tissue volume, spatial distribution of abnormalities changes over time were analyzed using the classified mapped data. A principal component analysis (PCA) was applied to assess lung shape variation between cohorts.

**Result**

Fibrosis usually has a consistently higher tissue density (0.3357, 0.4105 for reticular, ground-glass) compared to normal tissue (0.2752) over time, and mainly locates in lower lobes (72.18%, 57.6%, 64.85% for honeycomb, reticular, ground-glass). In contrast, emphysema has lower density (0.0784) and appears in upper lobes (72.65%) often. Most IPF patients experience a decrease of lung volume (11.85% off). The p-value of the first three mode based on PCA analysis are 0.001, 0.194 and 0.454 comparing IPF subjects and old normal ones.

**Conclusion**

The quantitative result shows that the sptial distribution of IPF disease is patchy, basal and peripheral, and the tissue density remains stable over time. There is a slightly shape difference between old normal persons and IPF ones.