Confocal Endomicroscopy Patterns for Diagnosis of Lung Cancer

Ortiz RM, Gil D, Minchole E, Diez-Ferrer M, Cubero N, Lopez-Lisbona RM, Sanchez C, Esteban A, Dorca J, Rosell A.

Background

New endoscopic techniques are being introduced to reduce uncertainty in peripheral pulmonary lesions (PPL) diagnosis and management. Probe-based confocal laser endomicroscopy (pCLE) is a technique that can microscopically image the lung tissue in vivo during flexible bronchoscopy, though it can be difficult for pulmonologists to distinguish cellular patterns in a monochrome vision under respiratory and cardiac movements. The goal of this work is to explore if Computed-Aided Diagnoses (CAD) tools can obtain a reliable diagnoses with pCLE in lung cancer.

Objective

To detect whether pCLE images contain enough texture and visual pattern information to discriminate between benign and malignant lesions and whether it could increase diagnostic accuracy versus visual assessment.

Methods

A pilot study using 2 different methods for pCLE pattern analysis was performed: one based on visual analysis by 3 experts and the other one based on computerized analysis of visual patterns called Graphcom. Twelve pCLE videos obtained using methylene blue dye (1%) and Alveloflex-Cellvizio 660nm miniprobe were selected from patients with endobronchial lesions (6 with lung cancer and 6 with inflammatory disease) during rigid bronchoscopy under general anesthesia. Afterwards, video sequences from pCLE were visually explored by one of the authors to select 10 frames that presented a clear cellular pattern, without artifacts. These images were shown to 3 observers who were familiar with confocal images but ignored the final histopathological diagnosis for a blind visual labeling. Images were also computationally analyzed using methods from social networks community analysis in a graph representation of pCLE images based on visual features to potentially overlapping groups of images that share common visual properties.

Results

Our preliminary results indicate that on average visual analysis with 3 independent experts can only achieve a 60.2% of accuracy and has large variability amongst observers, while the accuracy of the proposed unsupervised image pattern classification (GraphCom) rises to 83.4%.

Conclusions

Computation methods and graph structural analysis can increase diagnostic accuracy of pCLE images against visual analysis (83.4% vs 60.2%). Future studies are needed to apply this method in a real time scenario during bronchoscopy for PPL diagnoses.