

## TITLE

Integrated Analysis of Airways and Lung Parenchyma for Quantitative Assessment of COPD in CT Images

## BACKGROUND

Pulmonary emphysema and airway disease are primary phenotypes of COPD. While first algorithmic approaches for their individual quantitative assessment have already been developed, the need for a comprehensive, clinically applicable software system remains until today. For an integrated assessment of parenchymal and airway disease, robust detection of lungs, lobes and airways is to be combined by means of a simple workflow with reproducible quantification and clear visualization of extent and distribution of emphysematous areas and airway branches with conspicuous lumen/wall thickness ratios.

## EVALUATION

Applicability to clinical data was tested on a heterogeneous database of 125 cases. In a multi-observer study, the success rate of the lobe segmentation was determined to be 97.5% with a reproducibility of >99%. Airway analysis could be performed in all cases. Initial quantitative validation on a software phantom yielded a lumen and wall thickness accuracy of >90% for airways 3-6mm in diameter. In-vivo evaluation of airway segmentation and quantification quality is ongoing, and the software is currently used for evaluation studies at six clinical sites.

## DISCUSSION

With the broad availability of multi-detector CT devices, the potential benefits of computer assistance in the assessment of emphysema or airway disease are already widely accepted. However, especially when considering recent developments in bronchoscopic lung volume reduction and drug therapy for small airway disease, it becomes apparent that it is in many cases not sufficient to evaluate either disease individually. In order to exploit the full potential of computer assisted examinations, a combined analysis is required.

## CONCLUSION

We present a prototypical software assistant that integrates state-of-the-art segmentation, quantification, and visualization techniques for the examination of parenchyma and airways into a single, streamlined application that allows for a more comprehensive assessment of COPD.

Patient Name	
Patient ID	
Patient Birth Date	1924-01-01
Acquisition Date	2001-03-27
Case Description	N/A

  

Histogram Evaluation Results					
Scan Param	Vol (%)	Backsc	HL (HU)	PL (HU)	LSV
Overall	4498	100.0 %	-772	-918	-869 11.3 %
Right Lung	2409	53.6 %	-769	-917	-869 11.1 %
Left Lung	2089	46.4 %	-775	-919	-859 11.5 %
R. Upper Lobe	896	17.9 %	-771	-912	-859 9.6 %
R. Middle Lobe	430	9.6 %	-789	-928	-876 14.2 %
R. Lower Lobe	1173	26.1 %	-761	-917	-873 11.9 %
L. Upper Lobe	981	21.8 %	-782	-919	-859 11.4 %
L. Lower Lobe	1108	24.6 %	-768	-920	-873 11.6 %

  

Quantification Parameters	
Parameter	Value
Quantification Date	2009-04-15T17:59:34
Quantification Protocol Version	v5.02
Noise Reduction Filter Enabled:	NO
Upper Threshold(s) for Low Attenuation Volume (LAV)	-930 HU

