

EVALUATION OF EMPHYSEMA PROGRESSION IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD); 3HE 3D ADC MEASUREMENTS COMPARED WITH CT AND LUNG FUNCTION TEST, PRELIMINARY RESULTS.

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INTRODUCTION: The lung function tests traditionally used for monitoring the progression of emphysema in COPD are relatively insensitive and more sensitive measures of disease progression are needed. The ³He apparent diffusion coefficient (ADC) is known to be a sensitive biomarker of emphysema [1]. The aim of this study was to evaluate the use of ADC measurements in assessing progression compared to computed tomography (CT) and pulmonary function tests.

SUBJECTS AND METHODS: At baseline and after one year 20 patients (age: 60.1, SD= 5.0, male/female: 8/12) with moderate to severe COPD and 5 healthy smoking volunteers (age: 56.6, SD 7.1, male/female: 2/3) were examined with helium-3 MRI (3D diffusion weighted SPGR: diffusion time 1.5 ms, b = 1.6 s/cm², TR/TE = 8.6/5.7 ms, flipangle = 1.1 deg.) at full inspiration, as well as with CT with quantification of the fractional volume below 950 HU (CT-FV) reflecting the degree of emphysema and with pulmonary function tests with determination of the forced expiratory volume in 1 second (FEV1). The ADC values were analysed with an in-house developed program after manual segmentation of the trachea and main bronchi.

RESULTS: In the COPD group we found an increase of the mean ADC (0.07 cm²/s, SD 0.02 cm²/s), however not significant (p=0.10). No significant change in FEV1 was observed, whereas we found a significant increase of the CT-FV (see table 1). In the control group no changes were found. The COPD patients were included without prior knowledge of the emphysema degree, but based on baseline CT a subgroup of subjects with significant emphysema (CT-FV > 10%) was defined. In this emphysema subgroup of patients (n=12) we found a significant increase of the mean ADC (0.013 cm²/s, SD 0.01 cm²/s, p<0.05) and of the CT-FV (table 2). Ten of the emphysema patients (>80%) had increased or unchanged ADC at year 1 (Fig.1).

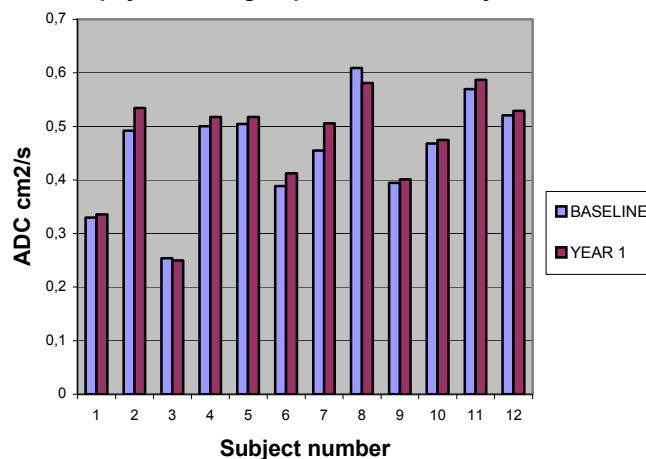
Table 1: Change after one year in mean ADC, CT-FV<950HU and FEV1

	ADC cm ² /s (SD)	CT-FV<950HU % (SD)	FEV1 l/s (SD)
COPD (n=20)	+0.007 (0.018) NS	+3.29 (2.63) p<0.001	-0.0625 (0.170) NS
Healthy controls (n=5)	-0.001 (0.016) NS	+0.82 (1.07) NS	-0.110 (0.100) NS

Table 2: Subgroup analysis: Change after one year in mean ADC, CT-FV<950 and FEV1 by COPD subgroup:

	ADC cm ² /s (SD)	CT-FV<950HU % (SD)	FEV1 l/s (SD)
Emphysema (n=12)	+0.013 (0.020) p<0.05	+3.75 (3.10) p<0.01	-0.048 (0.218) NS
Non-emphysema subgroup (n=8)	-0.002 (0.01) NS	+2.59 (1.67) p<0.05	-0.085 (0.070) p<0.01

Fig.1: Mean ADC for all subjects in the emphysema subgroup at baseline and year 1



DISCUSSION AND CONCLUSION: In contrast with previously published studies [2,3] we detected a significant annual increase in ADC, although only in a well-defined subgroup of COPD patients with CT diagnosed emphysema. This could be due to the use a 3D ADC sequence with better lung volume coverage, and a higher spatial resolution with more detailed information, although differences in the study populations cannot be excluded. A high proportion of current smokers in the emphysema subgroup (75%), causing a faster progression, could be of importance. The result suggests that ADC measurements might be used for monitoring the progression of emphysema.

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