01.05 - Clinical respiratory physiology, exercise and functional imaging

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Emphysema Severity Index (ESI): a novel spirometry-derived parameter in patients with COPD

COPD, Spirometry, COPD - mechanism

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Background. Spirometry detects airflow obstruction in COPD but cannot distinguish whether the obstruction is predominantly due to airway inflammatory narrowing or emphysematous parenchymal destruction.

Aim. To ascertain whether mathematical modeling of airway biomechanical properties by maximal expiratory flow/volume curve (MEFV) parameters could assess the relative contribution of emphysema to airflow obstruction in COPD.

Methods. In 340 patients with COPD (106 females, mean age 71±9 yr) we obtained spirometry, pletysmographic lung volumes (PLVs) and DLCO. The MEFV descending limb was fit by an algorithm implemented in a dedicated spirometer (Minispir-ESI, MIR, Italy) using as input variables absolute values of PEF, FVC and forced expiratory flows at 25, 50 and 75% of FVC to derive the emphysema severity index (ESI), a numeric parameter ranging from 0 to 10 previously proved to reflect CT quantitatively assessed emphysema in the COPDGene study (Occhipinti M et al. Respir Res 2020;21:103). The relationship between ESI, PLVs and DLCO was evaluated by linear correlation analysis.

Results. Mean (±SD) ESI value was 3.03 (2.37) with the vast majority of values ranging from 1 to 4, compatible with mild to moderate emphysema. ESI value correlated positively with PLVs (FRC% and RV% both $r=0.65$, $p<0.0001$) as well as negatively with DLCO ($r=0.52$, $p<0.005$).

Conclusions.ESI adds to spirometry the power to predict with reasonable accuracy the relative contribution of emphysema to airway obstruction in COPD. ESI could be used to better define the underlying mechanism of obstruction in clinical, pharmacologic and epidemiologic studies of COPD whenever spirometry is the only available examination.