Elastin Degradation Markers Are Elevated in Never-Smokers with Past History of Prolonged Exposure to Secondhand Tobacco Smoke and Are Inversely Associated with Their Lung Function

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Background- Prolonged past exposure to secondhand tobacco smoke (SHS) in never-smokers is associated with occult obstructive lung disease and abnormal lung function, in particular reduced diffusing capacity. Previous studies have shown ongoing SHS exposure to be associated with increased elastin degradation markers (EDM) desmosine and isodesmosine. Objective- To determine (1) whether EDM levels are elevated in persons with remote history of SHS exposure, and (2) whether those levels are associated with reduced lung function. Methods- We measured the plasma levels of EDM from 160 never-smoking flight attendants with history of remote but prolonged SHS exposure in aircraft cabin and 96 never-smoking flight attendants or sea-level control subjects without such history of cabin SHS exposure, and examined those levels against their lung function with adjustment for age and sex. The cabin SHS exposure was estimated based on airline employment history and dates of smoking ban enactment as previously described. EDM plasma levels were quantified by high-performance liquid chromatography and tandem mass spectrometry as previously described. All 256 subjects underwent spirometry, and 65 of the SHS-exposed flight attendants also underwent full pulmonary function testing. Results- The median [interquartile range; IQR] plasma EDM level for all subjects was 0.30 [0.25 to 0.36] ng/mL with a total range of 0.16 to 0.65 ng/mL. Plasma EDM levels were elevated in cabin SHS-exposed subjects compared to those not exposed (0.34±0.01 vs. 0.26±0.01 ng/mL; age- and sex-adjusted P<0.001) (Figure). In those with history of cabin SHS-exposure, EDM levels were inversely associated with diffusing capacity (P=0.009), the lung function index reflecting the state of pulmonary capillary bed (parameter estimate (PE) [95%CI]=4.9% [1.5% to 8.4%] decrease per 0.1 ng/mL increase in EDM). In addition, EDM levels were inversely associated with FEV₁ (P<0.001) and FEV₁/FVC (P<0.001), the spirometric indices used for determination of COPD (PE [95%CI]=8.9% [4.8% to 13.0%] and 6.3% [4.1% to 8.4%] decrease per 0.1 ng/mL increase in EDM, respectively). Discussion- Prolonged past exposure to SHS, even if remote, is associated with higher systemic elastin degradation markers that in turn is associated with lower lung function and in particular reduced diffusing capacity. These findings suggests that (1) long after being exposed to SHS, there is ongoing elastin degradation greater than what is expected from the aging process; and (2) the elastin degradation likely contributes to reduced lung function and in particular reduced pulmonary capillary bed as seen with COPD.
Figure—Elastin degradation markers levels in SHS-exposed and non-exposed subjects and their association with lung function. DES and IDES denotes to Desmosine and Isodesmosine.