

Lobar Pulmonary Aerosol Doses - Electronic vs Conventional Cigarette Smokers

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Electronic cigarettes (e-cigarettes) have grown in popularity because they are considered to be a less harmful and less toxic alternative to tobacco cigarettes, or a transitory way to quit smoking and they are also allowed in smoke-free environments. However, to date, their toxicity has not been scientifically proven compared to tobacco cigarettes. In addition, knowledge of the deposition characteristics of their aerosol component in the respiratory tree is important because the airway pathologies caused by deposition of particulate matter have often been reported to occur at specific sites in the lung, particularly within specific lobes (Winkler-Heil and Hofmann, 2009). Within this context, our study reports on size segregated dosimetry data for the aerosol from both kinds of cigarettes as function of the airway generation number in lung lobes. Aerosol from both kinds of cigarettes was diluted before entering the measuring section through a thermodilution system (two-step dilution), made up of a Rotating Disk Thermodiluter, RDTD (model 379020, Matter Engineering AG) and a thermal conditioner (model 379030, Matter Engineering AG). Total particle number concentrations and size distributions were measured by a Condensation Particle Counter (CPC 3775, TSI Inc.) and a Fast Mobility Particle Sizer spectrometer (FMPS 3091, TSI Inc.), respectively (Manigrasso et al, 2015).

Dosimetry estimates were carried out with the 60th percentile stochastic lung model included in the Multiple-Path Particle Dosimetry model (MPPD v2.1, ARA 2009). For each lung lobe (TBLU tracheobronchial left-upper lobe; TBLL tracheobronchial left-lower lobe; TBRU tracheobronchial right-upper lobe; TBRM tracheobronchial right-middle lobe; TBRL tracheobronchial right-lower lobe; PLU alveolar left-upper lobe; PLL alveolar left-lower lobe; PRU alveolar right-upper lobe; PRM alveolar right-middle lobe; PRL alveolar right-lower lobe), dosimetry data were reported as function of airway generation in terms of number of particles and number of particles per unit airway surface area. Total regional doses D^R (Figure 1) were higher for right lobes than for the left ones. In the TB region of the RU lobe, 116% (e-cigarette) and 123% (conventional cigarette) more particles were deposited than in the LU, and about 20% (e-cigarette) and 17%, (conventional cigarette) more were deposited in the RL than in the LL lobe. In the alveolar region, about 99% (e-cigarette) and 98% (conventional cigarette) more particles were deposited in the RU than in the LU lobe, and about 28% (both kinds of cigarettes) more were deposited in the RL

than in the LL lobe. D^R was higher in lower than in the upper lobes. In the TB region, about 85% (e-cigarette) and 87% (conventional cigarette) more particles were deposited in the LL than in the LU lobe. The dose received by the RL and RU lobe were similar: 3% higher and 1% lower for the RL lobe, for the electronic and conventional cigarettes respectively. In the alveolar region, D^R was about 79% (both kinds of cigarettes) higher for the LL than for the LU lobe, and about 16% (e-cigarette) and 15% (conventional cigarette) higher for the RL than for the RU lobe.

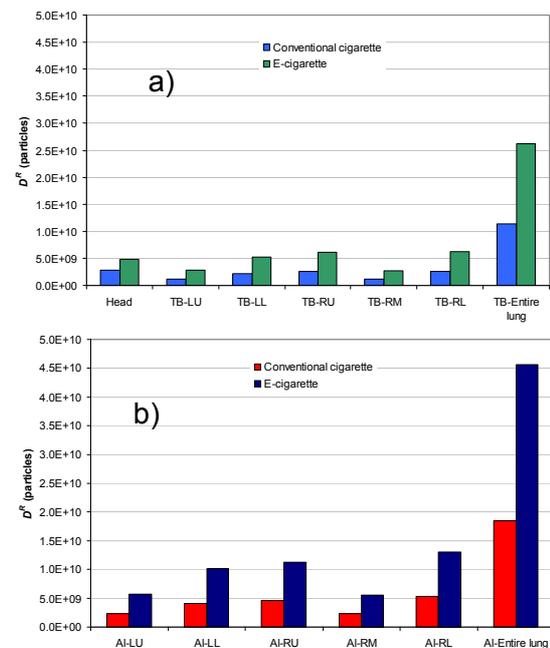


Figure 1. Total regional lobar doses (D^R) in the: (a) head (H) and tracheobronchial (TB); and (b) alveolar (Al) regions

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