Lobar deposition of inhaled aerosol in the mouse lung: preliminary analysis of the LAPD dataset

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Laboratory animals are often used to derive health risk from environmental exposure. To do so, it is important to measure not only the total dose of deposited particulates but also their spatial distribution in the lung. A unique database including both high resolution lung anatomy and deposition data in four strains of mice have been recently made available to the research community (Lung anatomy + particle deposition (LAPD) mouse archive: https://doi.org/10.25820/9arg-9w56). Using these data, we determined the effect of particle size (1 and 2 µm) on the distribution of deposited particles between lobes. Analysis was performed on a total of 30 mice where 16 (14) animals were exposed to 1µm (2µm) particles. Lobar deposition (volume) was normalized by the sum of deposition (volume) in each of the five lobes. For each animal, we then calculated the particle deposition to volume ratio for each lobe (DV_{lobe}). When $DV_{lobe} = 1$, particle deposition is proportional to lobar volume; when DV_{lobe} differs from one, lobar deposition is relatively greater ($DV_{lobe} > 1$) or smaller ($DV_{lobe} < 1$) than lobar volume. Lobes were denoted as follows: left (L), right cranial (RCr), right middle (RM), right caudal (RCa) and right accessory (RA).

For 1 µm (2µm) particles, *DV* ratios (mean±SD) were L:1.06±0.11 (1.04±0.18), RCr:1.17±0.11 (1.42±0.34), RM:0.96±0.18 (0.86±0.19), RCa:0.88±0.08 (0.82±0.13) and RA:0.88±0.10 (0.80±0.15). Significant deviation from 1 were found for *DV* ratio in the right cranial lobe (DV_{RCr}) where deposition was relatively greater than lobar volume. DV_{RM}, DV_{RCa} and DV_{RA} were all significantly <1 and lower than DV_L ($p<0.01$). Furthermore, DV_{RC} was positively correlated with particle size ($p=0.004$) and DV_{RA} was negatively correlated with particle size ($p=0.026$). DV_{RM} and DV_{RCa} also show a negative trend with respect to particle size but the regressions were not significant. In conclusion, we showed an uneven distribution of deposited particles among the lobes of the mouse lung. Thus, depending on the lobe, individual lobe analysis to determine overall deposition may either underestimate or overestimate total lung burden, at least for particles in the micron size range.

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