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Title: Aerosol deposition during acute bronchoconstriction studied by synchrotron radiation imaging in rabbits

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Body: RATIONALE: We assessed the effect of acute bronchoconstriction on regional aerosol deposition in the lungs of anaesthetized rabbits. METHODS: We used K-edge subtraction synchrotron imaging (KES), to quantify the deposition of iodine-containing aerosol (lomeprol 88 mg/ml in NaCl 0.9%, MMAD: 2.6±0.1 µm), in control and methacholine-challenged (Mch, 10 µg/kg/min IV) anaesthetized rabbits (Wt=2.9±0.1 kg) on pressure-controlled ventilation. Iodine deposition maps were obtained in 30 contiguous images after 5 minutes of nebulization. Airway (Raw) and tissue resistance (G) and elastance (H) were measured using forced oscillation technique. RESULTS: Iodine deposition showed significant heterogeneity (Figure) in both groups. Total iodine deposition was reduced in the Mch group, as well as tidal volume, with a significant correlation between the 2 parameters (R=0.83, p<10⁻⁶).

m±SD	Control (n=6)	Mch (n=6)
Total Deposition at 5 min (mg)	18.8±19.5	4.5±2.1*
VT (ml)	29.7±3.5	24.7±3.8*
Ve (l/min)	1.36±0.17	1.19±0.28
Raw (cmH2O.s/l)	9.7±2.6	29.6±10.5*
G (cmH2O/l)	140.0±21.6	177.1±44.3
H (cmH2O/l)	443.9±130.3	333.5±184.8

*: $p < 0.05$ vs. baseline.

CONCLUSIONS: KES imaging offers a unique tool for the measurement of regional aerosol deposition in vivo. These data highlight the relation between ventilation pattern and regional aerosol deposition, during acute bronchoconstriction under mechanical ventilation.