IMAGING OF AIRWAY SURFACE VIA SYNCHROTRON LIGHT: TOWARDS NON-INVASIVE ASSESSMENT OF CF AIRWAY THERAPIES

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Cystic fibrosis produces progressive lung destruction and early death. Treatments to correct the ion-channel pathophysiology of the disease attempt to increase the depth of the thin (<10um) airway surface liquid (ASL). In studies developing airway gene therapy, we seek to measure ASL depth non-invasively. In this proof-of-concept study we examined whether propagation-based (phase contrast) imaging (PBI) could image airway surfaces in live mice to measure the airway surface liquid depth. **Methods**: Six anaesthetised C57Bl/6 mice (5 adult, 1juvenile) were imaged through the skull and neck at the JASRI SPring-8 synchrotron. Images were captured on a CCD detector (6.6 or 1.1 µm pixel size) with a 25 keV beam and a 150 cm propagation distance. Exposure times between 100 ms and 500 ms were used. **Results:** Airway surfaces and skull structures were revealed with remarkable clarity. Olfactory turbinates, nasopharynx, trachea, bone suture lines, cochlea and neck vertebrae normally only observable at this resolution via histological sectioning were apparent. The nasal septum (where gene therapy assessments are focussed) were easily located in adults and juveniles. Obliquely directed imaging was clearer since overlying bone could be eliminated. Instilled saline provided lumenal gas bubbles showing well-defined edges. Assessment of maximum resolution was prevented due to interference by body fur. **Conclusions**: Very high resolution, non-invasive imaging of airway surfaces is feasible with PBI. Expected future technical improvements in animal preparation, dose, and detectors suggest synchrotron PBI could provide repeated non-invasive imaging of airway surfaces. Synchrotron PBI imaging has potential as a novel, non-invasive, high-resolution method to repeatedly assess airway health and disease in CF.
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