Non-invasive airway health assessment: synchrotron imaging reveals effects of rehydrating treatments on mucociliary transit in-vivo

To determine the efficacy of potential cystic fibrosis (CF) therapies we have developed a novel mucociliary transit (MCT) measurement that uses synchrotron phase contrast X-ray imaging (PCXI) to non-invasively measure the transit rate of individual micron-sized particles deposited into the airways of live mice. The aim of this study was to image changes in MCT produced by a rehydrating treatment based on hypertonic saline (HS), a current CF clinical treatment. Live mice received HS containing a long acting epithelial sodium channel blocker (P308); isotonic saline; or no treatment, using a nebuliser integrated within a small-animal ventilator circuit. Marker particle motion was tracked for 20 minutes using PCXI. There were statistically significant increases in MCT in the isotonic and HS-P308 groups. The ability to quantify in vivo changes in MCT may have utility in pre-clinical research studies designed to bring new genetic and pharmaceutical treatments for respiratory diseases into clinical trials.