

Evaluation of Lung Clearance Index in Children with Cystic Fibrosis Compared to Canadian Controls

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Rationale: Groups in Sweden and the UK have demonstrated that the lung clearance index (LCI), a marker of overall ventilation inhomogeneity within the lung derived from the Multiple Breath Washout (MBW) test, has a narrow range of values in reference populations that is almost identical across studies, and seems to be independent of subject age, sex, height and weight. These groups have also shown that LCI is a sensitive tool for detecting cystic fibrosis (CF) lung disease in children with normal spirometry. While the findings from these clinical studies are promising, data confirming these results from controls and patients in North America are lacking.

Objective: Our objective was to compare our own paediatric normative data with that of the groups from Sweden and the UK, and to assess if LCI detected abnormalities in our CF patients with mild lung disease.

Methods: We measured baseline LCI values derived from a group of 28 healthy children aged 6-18 years and an age-matched cohort of 19 children with CF with a FEV1 > 80 % predicted. Our equipment and set-up were the same as described by the groups in Sweden and the UK. LCI was calculated as the number of lung volume turnovers (TO) needed to lower the end-tidal concentration of inert gas to 1/40th of its starting concentration. The TO was calculated at each breath as the cumulative expired volume (CEV) divided by the FRC.

Results: Mean LCI values for our group of healthy children was 6.13 (standard deviation (SD): 0.41, 95% CI: 5.97 to 6.29), which is congruent with published normative data from Sweden (mean LCI: 6.33, SD: 0.43) and from the UK (mean LCI: 6.45, SD: 0.49). LCI was significantly higher in our cohort of children with CF compared to our healthy controls (mean difference 2.77 (95% CI 1.84 to 3.7), p<0.001). Furthermore, LCI detected 13 (68%) of the children with CF as having an abnormal LCI, defined as a value above +1.96SD of the mean LCI from our healthy control group.

Conclusions: The normative data from our group of healthy controls confirms the findings of groups in Sweden and the UK that LCI maintains a narrow normal range of values that is consistent across research locations. The LCI was able to detect abnormalities in a high proportion of children with mild CF disease, suggesting that LCI may be a more sensitive assessment than spirometry in this disease.