WS20.1 Are pre-school lung clearance index (LCI) measurements a predictor for later structural lung disease?

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Objectives: LCI is a promising outcome measure to monitor early CF lung disease. To validate LCI we evaluated the predictive value of pre-school LCI for later structural lung disease.
Methods: Retrospective cohort study of 31 CF patients. Routine annual LCIs (expressed as Z-scores) were obtained between 0 and 6 years. Routine triennial chest CTs were obtained between 5 and 17 years. CTs were scored in random order using the CFCT scoring system (expressed as % of maximum score). GEE analysis, results expressed as odds ratios (OR), were used to evaluate age at CT and LCI (above vs below the median value) as risk factors for abnormal structure defined as total CFCT >5%, trapped air >30% and bronchiectasis >0%.
Results: 129 LCI measurements and 73 CTs (⩽4 per patient) were obtained. LCI (median value 3.6) did not correlate with age ($p = 0.36$). Fraction of cases with CFCT >5% at the 4 subsequent CTs were 0.16, 0.33, 0.60 and 0.83, respectively. For the endpoints trapped air and bronchiectasis these fractions were 0.06, 0.05, 0.20, 0.33 and 0.26, 0.48, 0.60, 0.83, respectively. For each endpoint risk increased with age at CT (all $p < 0.05$).
The risk for CFCT >5% was increased for patients with LCI >3.6 (age adjusted OR=4.0, $p = 0.045$). The risk for trapped air increased more, i.e. with a steeper slope, with advancing age for patients with LCI >3.6 ($p = 0.009$). At age 6, there was no difference between the two LCI groups ($p = 0.9$). At age 15 there was an increased risk (OR=39.2, $p = 0.001$). No significant relation was found between LCI and bronchiectasis.
Conclusion: High LCI in the pre-school age is predictive for faster progression of trapped air but not for bronchiectasis.

WS20.2 Difference between multiple breath washout with N_2 (MBWN2) vs SF_6 (MBWSF6) in 12 months follow up in children with CF

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Objectives: MBWSF6 has been used for more than 10 years at the Gothenburg CF center and a switch to MBWN2 is now planned.
Aim: To compare change of LCI calculated by MBWN2 and SF6 over a follow-up time of 12 months in children with CF.
Methods: All children between 7 and 18 years performing MBWN2 (Exhalyzer D) and MBWSF6 the same day at the annual review after 1 or 2 years were included. To accept a test at least two acceptable washouts were required. Non-parametric tests were used for statistical calculation.
Results: 21 children (9F), median age 11.5 yrs (7.5–17.1) were included. In two patients the 2nd MBWN2 failed. Median LCIN2 and LCISF6 at start were 9.12 (6.37–19.98) and 8.12 (6.00–14.82) respectively ($p < 0.001$) but correlated well ($r_s = 0.942$). Both methods correlated similarly well with FEV1.0 ($r_s = 0.792$ and 0.786 respectively). In the normal range of LCI, the methods showed similar values while the difference increased at higher LCI with relatively higher LCIN2 compared to LCISF6.
At follow-up, only LCISF6 had increased significantly, 8.45 (6.31–17.07) ($p = 0.008$). The difference in outcome between 1st and 2nd LCIN2 and LCISF6 seemed to increase with increasing baseline LCI ($r_s = 0.428$, $p = 0.064$) but only in 1/19, in the patient with the highest LCIN2 at start (LCI 19.98), the result was contradictory (showing increase >1 unit with LCISF6 and a decrease >1 unit with LCIN2).
Conclusion: Both methods correlate well with FEV1.0 and with each other cross-sectionally. The magnitude of the difference in change of LCIN2 and LCISF6 over one year seems to be influenced by the level of LCI at start.

WS20.3 Lung clearance index and *Aspergillus* colonization are clinical markers of chronic lung changes by spirometry controlled CT in children with cystic fibrosis

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Computed tomography (CT) is a highly sensitive tool in detecting chronic lung changes. Spirometry control during imaging standardizes the breath hold procedure and improves the usability of images.
Objective: To explore the relation between chronic lung changes by spirometry controlled CT (SCCT) and clinical markers of lung disease; lung function (Nitrogen Multiple Breath Washout (N2MBW) spirometry, diffusion capacity), microbiology (growth and serum markers) from the year prior to examination, and quality of life questionnaires (CFQ-R) in children with cystic fibrosis (CF).
Methods: Children with CF were examined with SCCT, lung function measurements and questionnaires on the same day. CT scans were scored using the CFCT scoring method, as previously described.
Results: Sixty-four CF children were examined (mean (range) 12.3 (6.4–18.1) years). Mean CFCT total score was 11.3% (range 0.4–46.8%) The clinical parameter with the strongest correlation to CFCT score was lung clearance index (LCI) derived from MBW ($r^2 = 0.82$ $p < 0.0001$). Multiple regression analysis adjusted for LCI, showed that *Aspergillus* colonization was a significant predictor of chronic lung changes, using percentage positive growth the previous year and *Aspergillus* IgG levels as variables for analysis. ($p = 0.038$ and $p = 0.003$ respectively).
Conclusion: Using SCCT we found a closer correlation of LCI to CFCT score than previously reported. Furthermore we find that *Aspergillus* colonization significantly relates to chronic lung changes. This could have implications concerning management of both intermittent and chronic *Aspergillus* colonization.

WS20.4 Is lung clearance index (LCI) affected by the severity of lung disease in CF?

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Aim: To assess whether the correlation between LCI, FEV_1 and Bhalla score is affected by disease severity.
Method: Forty-four children and adolescents with CF participated in the study. Spirometry and multiple-breath-washout tests were performed. $LCI_{2.5}$ and LCI_5 were calculated. $LCI_{2.5}$ reflects N_2 washout until 1/40th of the starting N_2 end-tidal concentration (cet), i.e. 2.5% and LCI_5, reflects N_2 washout until 1/20th of the starting cet, ie 5%. All children had a HRCT scan, which was evaluated using the modified Bhalla score. The study population was divided into three groups, according to FEV_1 % predicted values: (a) ⩾85% (normal), (b) 70–84% (mild disease) and (c) 40–69% (moderate disease).
Results: The patients' mean age was 12.9 years (47.7% boys) and mean FEV_1: 91.2%. Among children with *normal* spirometry, $LCI_{2.5}$ showed significant correlation with FEV1% ($p = 0.049$), with the severity and extent of bronchiectasis ($p < 0.0001$), generation of affected bronchi ($p < 0.0001$) and mucus plugging ($p = 0.004$). Among patients with *mild disease* $LCI_{2.5}$ correlated significantly with FEV_1% ($p = 0.013$). Among patients with *moderate disease* LCI_5 was correlated with FEV_1% ($p < 0.0001$).
With multiple regression analysis, LCI was found to be a good predictor for the severity and extent of bronchiectasis, peribronchial thickening and generation of bronchial division involved ($p < 0.001$) for the patients with normal FEV_1%, but not for patients with mild or moderate lung disease.
Conclusions: In early lung disease LCI is a very useful tool to detect lung disease. In moderate lung disease, LCI_5 and FEV_1 are both useful tools for the detection of lung disease.