**2023 DSPAP årsmøde**

Using Lateral Decubitus Computed Tomography (CT) to Monitor Structural Lung Disease in Young Children with Cystic Fibrosis

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**Rationale**

Cystic fibrosis (CF) structural lung disease is monitored using chest computed tomography scans (cCTs). Preschool children are mostly not able to follow breath-hold commands for which reason inspiratory and expiratory cCTs are performed in general anesthesia by some centers using a pressure-controlled protocol. cCTs taken in lateral decubitus position is thought to result in an expiratory lung volume of the dependent lung and in an inspiratory lung volume of the contralateral lung. We aimed to evaluate the feasibility and sensitivity of lateral decubitus CT to detect structural lung disease in preschool children with CF.

**Methods**

From 2012 to 2022 all preschool children with CF followed at Copenhagen CF Center who had at least one cCT in lateral decubitus position, were enrolled. Coded cCTs were scored in random order at LungAnalysis (Erasmus MC, Rotterdam). The quality of cCTs was evaluated for their suitability to be scored. For each study cCT, one left lateral position CT (right lung inspiratory, left lung expiratory) and one right lateral position CT (right lung expiratory, left lung inspiratory) was scored using PRAGMA-CF, assessing the following structural lung abnormalities on the inspiratory cCT: bronchiectasis [%BE], mucus plugging [%MP], airway wall thickening [%AWT], and atelectasis [%Atelec], and %Dis (sum of all abnormalities), and on the expiratory cCTs Trapped air (%TA).

Lung volumes of the left and right lung were computed using Myrian® (version 2.9.2, France). First, the left and right lung were segmented automatically followed by manual correction of segmentation errors.

**Results**

In total 48 patients (mean [SD] age 1.98 [1.13]) and 73 cCTs were included (33 patients had 1 cCTs, 5 patients had 2 cCTs, and 10 had 3). Quality of left and right lateral position cCTs was good in 75% and 68%, moderate in 21% and 29%, and poor in 4% and 3%, respectively. Bronchiectasis was observed on 59(81%) with a mean (SD) 0.67(0.92) %; %Dis was 5.58(6.88) %. Atelectasis was present on 54(74%) with a mean (SD) of 2.40(3.98) %. Trapped air was present on 37(51%) with a mean (SD) of 3.14(7.61) %. Lung volume was successfully measured on 58 cCTs (15 excluded because of slice increment >3mm). Lung volume for inspiratory and expiratory was 505.9(198.8) mL and 246.8(140.9) mL, respectively. Mean inspiratory/expiratory volume ratio was 1.47(0.16).

**Conclusions**

Lateral decubitus cCTs and PRAGMA-CF is a feasible and sensitive technique to detect structural abnormalities on both inspiratory and expiratory cCTs for monitoring structural lung disease and trapped air in preschool children with CF.

**Figure.** PRAGMA-CF inspiratory and expiratory scores distribution

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