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**Title:** Differences in regional pulmonary function between children with cystic fibrosis and healthy children determined by electrical impedance tomography

Dr. Barbara 4422 Vogt barbara.vogt@uksh.de MD [1], Mr. Zhanqi 4423 Zhao zha@hs-furtwangen.de [2], Dr. Christian 4424 Falkenberg christian.falkenberg@drv-nord.de MD [3], Dr. Tobias 4426 Ankermann ankermann@pediatrics.uni-kiel.de MD [4], Ms. Inken 4425 Kaak inkenkaak@gmx.de [3], Prof. Dr Norbert 5113 Weiler norbert.weiler@uksh.de MD [1] and Prof. Dr Inéz 5127 Frerichs inez.frerichs@uksh.de MD [1]. [1] Department of Anesthesiology and Intensive Medicine, University Medical Centre Schleswig-Holstein, Campus Kiel, Kiel, Germany, 24105 ; [2] Institute of Technical Medicine, Furtwangen University, Villingen-Schwenningen, Germany, 78054 ; [3] Department of Pediatric Pulmonology, Rehabilitation for Children and adolescents, Clinic Satteldüne, Nebel, Amrum, Germany, 25946 and [4] Department of Pediatrics, University Medical Centre Schleswig-Holstein, Campus Kiel, Kiel, Germany, 24105 .

**Body:** Introduction: Electrical impedance tomography (EIT) is able to assess spatial ventilation heterogeneity thanks to its ability to trace rapid regional lung volume changes. The aim of our study was to determine the differences in regional lung function between children with cystic fibrosis (CF) and healthy children using EIT. Patients and methods: We examined 26 healthy children (12±3 yr, mean age±SD), 26 children with CF colonized with Pseudomonas aeruginosa (P.a.) (12±3 yr) and 20 CF children without P.a. colonization (9±3 yr) by EIT at 33 scans/s in parallel with conventional pulmonary function testing (PFT). We determined the following regional EIT-derived PFT measures in 912 image pixels:FVC, $FEV_1$, PEF, $MEF_{50}$, $MEF_{25-75}$, FIVC, $FIV_1$, PIF, $MIF_{50}$. Coefficients of variation (CV) were calculated from all pixel values of each parameter to assess the spatial ventilation heterogeneity. Results: Significant differences were found in regional FVC, $FEV_1$, FIVC, $FIV_1$, PIF, $MIF_{50}$ between healthy and diseased children but not between the two CF groups. The CV values of FVC, $FEV_1$, PEF, $MEF_{50}$, $MEF_{25-75}$, FIVC, PIF and $MIF_{50}$ were higher in children with CF with P.a. than in healthy children. The only differences between the healthy and the P.a. negative CF groups were in CV of $MEF_{50}$ and $MEF_{25-75}$. The P.a. positive and negative CF groups differed from each other in CV of PEF, $MEF_{50}$ and FIVC. $MEF_{50}$ discriminated all three groups. Conclusion: EIT is able to detect regional lung function differences between the CF children with or without P.a. colonization and healthy children. The highest ventilation heterogeneity was found in the P.a. positive CF children.