Structured Light Plethysmography as a method of recording disease severity in Cystic Fibrosis

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Exposure to medical imaging increases with both age and severity of Cystic Fibrosis (CF)[1]. This study investigates the evaluative capability of Structured Light Plethysmography (SLP), compared to established radiology and lung function (LFT).

Stable individuals diagnosed with CF performed contemporaneous SLP, X-Ray and LFT (n=57). X-rays were independently appraised using the modified Chrispin Norman scoring system, with scorers blinded to SLP. Consent and national ethical approval were obtained.

X-Ray and LFT were normal until the age of 9 years. Bronchiectasis was the primary X-Ray pathology, which initiated and progressed largely in the upper pulmonary zones. Inspiratory Time (Ti), and Time to Peak Expiratory Flow/ Expiratory Time (Tptef/Te) decreased with disease severity (Table 1, $P<0.05$). Progression of CF was related to a reduced spontaneity of ribcage contribution and thoracoabdominal phase ($P<0.05$).

Median FEV1 SR	RR (bpm)	Ti (s)	Tptef/Te
-3.53	18.37	1.33	0.25
-2.13	18.38	1.40	0.30
-0.37	16.40	1.53	0.32
0.70	16.71	1.58	0.33

Airflow limitation led to an abnormal SLP Ti/total breath time (Ti/Ttot), and subsequent thoracoabdominal asynchrony. X-Ray line shadows correlated with Tptef/Te (-0.42), mottled with Ti (-0.41), while large soft shadows with Ti/Te (-0.49) and Ti/Ttot (-0.51) respectively ($p<0.05$). FEV1 standardised residual (SR) was associated with respiratory rate (RR) (-0.41), Ti (0.49), and Ttot (0.41) respectively ($p<0.05$).

Overall, a reduction in SLP Ti/Ttot is consistent with airflow limitation as CF bronchiectasis progresses. There is potential to reduce CF imaging below the age of 9 years without clinical indication.

1.O'Connell, O.J. et al Chest 2012; 141(6):1575-1583