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Title: Effect of airflow obstruction on the measurement of lung volumes

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Body: Effective alveolar volume (V_A) is considered as a representative of Total Lung Capacity (TLC) in subjects without airflow obstruction. In the presence of airflow obstruction, physiological changes can give rise to discrepancies between TLC and V_A . Aim: To assess whether V_A correlates with TLC and ascertain whether these differences are amplified in relation to the increase in severity of airflow obstruction. Method: Data was analysed retrospectively and divided into 2 groups based on TLC measured by either body plethysmography (pleth) or helium dilution (He). Results were classified by FEV_1 , using the NICE COPD guidelines 2010¹. Data was analysed using regression, Bland-Altman and ANOVA. Results: The magnitude of TLC - V_A increased significantly ($p < 0.001$) in relation to the severity of airflow obstruction. Bland-Altman gave a bias of 1.38 and 1.39 for helium and plethysmography respectively. A single equation was derived to predict the differences between TLC and V_A : $(TLC_{xx} - V_A) = 2.98 - 0.024 FEV_1\%Pred$

Table 1: TLC and V_A difference in relation to severity of airflow obstruction as classified by the COPD guidelines

	Mild	Moderate	Severe	Very Severe
N	5	23	28	8
TLC _{Pleth} - V_A (L)	0.8±0.3	1.3±1.1	1.8±1.1	3.1±1.6
N	20	46	47	26
TLC _{He} - V_A (L)	0.9±0.4	1.5±0.9	1.8±1.1	2.9±1.3

Conclusion: 1. V_A underestimates TLC 2. As severity of airflow obstruction increases, the magnitude of discrepancy between TLC_{pleth} and V_A and TLC_{He} and V_A increases 3. Overall, V_A is unable to substitute TLC in subjects with COPD, particularly those with more severe airflow obstruction 1. National Clinical Guideline Centre, 2010. Chronic Obstructive Pulmonary Disease in adults in primary and secondary care. London: National Clinical Guideline Centre.