Relationship Between FEV₁ and Expiratory Flow Limitation at Hospitalised COPD Exacerbation

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Rationale: Current management for hospitalised COPD patients avoids effort dependent forced manoeuvres to measure lung function. Expiratory flow limitation (EFL) during tidal breathing is effortless and can be easily measured in COPD patients. Within-breath changes in reactance at 5Hz (ΔXrs₅Hz) using forced oscillation technique (FOT) have been validated as a measure of EFL in COPD patients (Delleca 2004). However, it is uncertain how EFL relates to airflow severity at COPD exacerbations. We hypothesised that EFL associates with COPD airflow severity during a COPD exacerbation.

Methods: A prospective cohort study design was used, with 30 COPD patients admitted due to COPD exacerbations. At admission, patients underwent measurements of EFL and spirometry. EFL was measured using FOT (Resman Pro, ResTech, Milan, Italy), in seated and supine positions. The presence of EFL was defined as (ΔXrs₅Hz) more than 2.8 cmH₂O/(L/s), as proposed by Dellaca 2004. Lung function was measured using an EasyOne Air Spirometer (NDD Medzintechnik AG, Switzerland).

Results: 30 hospitalised patients (13 male) with COPD exacerbations were consecutively recruited with mean age of 73.93±10.29 years and body mass index of 24.4±8.78 kg/m². The mean FEV₁ was 0.87±0.37 L, 35.38±12.9% predicted and FEV₁/FVC % was 41.67±8.7. The mean EFL was 3.65±3.48 cmH₂O/(L/s) in the seated position and 5.11±4.41 cmH₂O/(L/s) in the supine position. EFL was present in 46.7% in the upright seated position and 53.3% in the supine position. There were significant negative correlations between FEV₁ and EFL in the seated position (r= -0.39, p=0.03) and in the supine position (r= -0.43, p=0.02), in which those with more severe airflow limitation (lower FEV₁) have greater EFL (figure 1). Conclusion: Our results show that during hospitalisation due to COPD exacerbation, those with more severe airflow limitation defined as a reduced FEV₁ have greater EFL. The severity of EFL increased when patients moved from a seated to a supine position. Detecting EFL at COPD exacerbation could be used to identify those with more severe physiological disturbance and to assess their response to treatment during recovery. This could have a clinical value, by providing an effortless test to measure lung function parameters during a COPD exacerbation requiring hospital admission.
Figure 1: Scatter plot demonstrating the correlation between EFL and FEV₁ at seated and supine positions.

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