Peak inspiratory flow and spirometry measures in COPD patients – the POROS Study

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Introduction

Peak inspiratory flow (PIF) has been shown to be associated with exacerbation severity in chronic obstructive pulmonary disease (COPD) and with subsequent hospital readmission. However, PIF is not routinely measured and thus rarely available in electronic health records. Finding strong proxy measures for PIF which are available from spirometry and routine patient care parameters, would be valuable in improving COPD management.

Methods

This was a retrospective observational study using data collected at Attikon hospital, Athens, Greece, in COPD patients during an unplanned hospitalisation for a COPD exacerbation. Spirometry was conducted using a portable PC-based spirometer (Easy on-PC). PIF was measured using In-Check device with 4 resistance settings simulating: Handihaler, Aerolizer, Diskus and Turbohaler devices.

Univariable and multivariable linear regression models were used to investigate the association between PIF and other lung spirometry measures taken on the day of discharge, co-morbidities, and demographics.

Results

The study sample consisted of 47 COPD patients with PIF and spirometry data. The mean age was 71 years (SD 9.0) and 72% were male. Overall, 81% were classified as GOLD group (2016) D (high risk patients with more exacerbations), and 30% had at least 1 severe exacerbation in the past year. The most prevalent comorbidities were hypertension (70%) and cardiovascular disease (53%).

In unadjusted analysis for Aerolizer and Diskus, FEV_1 and % Predicted PEF were significantly associated with PIF. For turbohaler, PIF was also significantly associated with % predicted FVC, % predicted FEV_1 and log(FEF_{25-75}). However, all measures were weakly (R^2<0.3) correlated with PIF (Table 1). In the final multivariate regression model for Aerolizer, FEV_1 and Gastroesophageal reflux disease (GERD) were the factors associated with PIF. The final model for Diskus included FEV_1, age, and Ischaemic Heart Disease (IHD), and for Turbohaler, FEV1 and % predicted PEF. However, R-squared values of the regression models for all 3 devices were weak (<0.4). Regression for Handihaler did not allow for adequate model fit, and thus was not further analysed.

Conclusion

All of the routine lung function measures were only weakly associated with PIF, despite statistical significance. While PIF measurement would be a valuable addition to standard of care in COPD management, it needs to be measured directly.

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Table 1. Simple linear regression for association between spirometry measures and PIF

		Simple linear regression	
In-Check setting	**Covariate**	**Parameter estimate (95% CI)**	**R-squared statistic**
Aerolizer	FEV_1	18.4 (2.6, 34.3)*	0.109
	FEV_1/FVC	20.6 (-31.2, 72.5)	0.014
	% predicted FVC	0.40 (-0.091, 0.89)	0.056
	% predicted FEV_1	0.29 (-0.11, 0.69)	0.045
	log(FEF_{25-75})	8.4 (-3.5, 20.3)	0.046
	% predicted PEF	0.47 (0.10, 0.84)*	0.133
Diskus	FEV_1	19.9 (6.8, 33.0)*	0.172
	FEV_1/FVC	23.7 (-20.5, 67.9)	0.025
	% predicted FVC	0.39 (-0.032, 0.81)	0.071
	% predicted FEV_1	0.29 (-0.053, 0.63)	0.061
	log(FEF_{25-75})	7.4 (-2.6, 17.4)	0.050
	% predicted PEF	0.41 (0.091, 0.74)*	0.134
Turbohaler	FEV_1	16.1 (7.2, 24.9)*	0.230
	FEV_1/FVC	28.7 (-1.4, 58.8)	0.076
	% predicted FVC	0.39 (0.11, 0.67)*	0.151
	% predicted FEV_1	0.35 (0.13, 0.58)*	0.180
	log(FEF_{25-75})	9.0 (2.4, 15.5)*	0.152
	% predicted PEF	0.43 (0.22, 0.63)*	0.294

a) FEV_1 = Forced Expiratory Flow in one second (litres); b) FVC = Forced Vital Capacity c) FEF_{25-75} = Forced Expiratory Flow; d) PEF = Peak Expiratory Flow *Statistically significant