“Silent hyperinflation" in COPD: MPT-derived dynamic hyperinflation escapes CAT-based symptom scoring despite links to dyspnea indices and cardiovascular comorbidity

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Introduction
Dynamic hyperinflation (DH) is one of the drivers of dyspnea in COPD, yet whether objectively measured DH is captured by standard symptom questionnaires is unknown. Metronome-paced tachypnea (MPT) could enable standardized quantification of DH as reflected by the decrease in inspiratory capacity (ΔIC). We hypothesized that DH may remain clinically "silent" to global symptom scores while still tracking dyspnea-specific indices, and explored whether cardiovascular comorbidity (CVD) influences this relationship.

Methods
We retrospectively analyzed 29 patients with COPD who underwent pulmonary function testing and MPT (ΔIC during MPT from 20 to 40 bpm, % fall in IC; with higher values indicating greater DH). Symptom burden was assessed using the COPD Assessment Test (CAT; ≤10 mild, 11–20 moderate, 21–30 high, ≥31 very high), the Dyspnea Index (DI) and modified Medical Research Council (mMRC) scale. CVD was present in 19 of 29 patients (65.5%). Associations were tested with Spearman correlation, Mann–Whitney U and Kruskal–Wallis tests; given the exploratory design and multiple comparisons, findings were not corrected for multiplicity and should be considered hypothesis-generating.

Results
ΔIC MPT was not associated with CAT score ($\rho=0.05$, $p=0.805$) and did not differ across CAT severity categories (Kruskal–Wallis $p=0.677$), suggesting that CAT may not capture objectively measured hyperinflation. By contrast, ΔIC MPT showed a nonsignificant inverse trend with DI ($\rho=-0.27$, $p=0.159$), while CAT correlated significantly with DI ($\rho=-0.44$, $p=0.017$), supporting the possibility that this dissociation is specific to CAT rather than to symptom perception overall. DI was significantly worse in patients with CVD than in those without CVD (median 0 vs −1.5; $p=0.023$), whereas ΔIC MPT was lower in the CVD group (median 15 vs 19.5; $p=0.059$), suggesting that CVD may contribute to greater perceived dyspnea despite lower levels of mechanical hyperinflation.

Conclusions
To our knowledge, this study provides early evidence that CAT-defined symptom burden may be dissociated from MPT-quantified dynamic hyperinflation in COPD, suggesting a “silent hyperinflation” phenotype that may be clinically under-recognized. The observed inverse trend between DH and TDI suggests that this dissociation may be instrument-specific rather than reflecting a complete absence of symptom–mechanics coupling, while the CVD findings point to cardiovascular status as a potential contributor to perceived dyspnea. These data support consideration of objective hyperinflation assessment in the COPD work-up, including in patients with low CAT scores, and warrant larger prospective studies integrating cardiopulmonary phenotyping into symptom-based COPD management.