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# Mechanisms of orthopnoea in patients with advanced COPD

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**Orthopnoea, a troublesome symptom in patients with severe COPD, is associated with increased neural drive to the diaphragm and heightened respiratory effort to compensate for abrupt augmentation of load-capacity imbalance of the inspiratory muscles** <https://bit.ly/2ZLvyiI>

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**ABSTRACT** Many patients with severe chronic obstructive pulmonary disease (COPD) report an unpleasant respiratory sensation at rest, which is further amplified by adoption of a supine position (orthopnoea). The mechanisms of this acute symptomatic deterioration are poorly understood.

Sixteen patients with advanced COPD and a history of orthopnoea and 16 age- and sex-matched healthy controls underwent pulmonary function tests (PFTs) and detailed sensory-mechanical measurements including inspiratory neural drive (IND) assessed by diaphragm electromyography (EMG<sub>di</sub>), oesophageal pressure ( $P_{es}$ ) and gastric pressure ( $P_{ga}$ ), in both sitting and supine positions.

Patients had severe airflow obstruction (forced expiratory volume in 1 s (FEV<sub>1</sub>): 40±18% pred) and lung hyperinflation. Regardless of the position, patients had lower inspiratory capacity (IC) and higher IND for a given tidal volume ( $V_T$ ) (*i.e.* greater neuromechanical dissociation (NMD)), higher intensity of breathing discomfort, higher minute ventilation ( $V'_E$ ) and higher breathing frequency ( $f_B$ ) compared with controls (all  $p<0.05$ ). For controls in a supine position, IC increased by 0.48 L *versus* sitting erect, with a small drop in  $V'_E$ , mainly due to reduced  $f_B$  (all  $p<0.05$ ). By contrast, IC remained unaltered in patients with COPD, but dynamic lung compliance ( $C_{Ldyn}$ ) decreased ( $p<0.05$ ) in the supine position. Breathing discomfort, inspiratory work of breathing (WOB), inspiratory effort, IND, NMD and neuroventilatory uncoupling all increased in COPD patients in the supine position ( $p<0.05$ ), but not in the healthy controls. Orthopnoea was associated with acute changes in IND ( $r=0.65$ ,  $p=0.01$ ), neuroventilatory uncoupling ( $r=0.76$ ,  $p=0.001$ ) and NMD ( $r=0.73$ ,  $p=0.002$ ).

In COPD, onset of orthopnoea coincided with an abrupt increase in elastic loading of the inspiratory muscles in recumbency, in association with increased IND and greater NMD of the respiratory system.