The importance of lung hyperinflation during exacerbations of COPD

Chronic obstructive pulmonary disease (COPD) exacerbations cause an increase in symptoms and reduction in health status that may last for a number of weeks. It is recognised that lung hyperinflation is an important determinant of both exercise limitation and bronchodilator responsiveness, and this study investigates the role of hyperinflation during a disease exacerbation.

Methods
Within 3 days of onset of an acute exacerbation, 20 patients with moderate-to-severe COPD (mean forced expiratory volume in one second (FEV1) 0.92 L; 41% predicted) had their lung function, breathing pattern and metabolic parameters measured and completed dyspnoea questionnaires. Measurements were repeated at 14, 30 and 60 days to assess physiological change during recovery and relate this to improvement in dyspnoea.

Results
Each patient experienced worsening dyspnoea as a primary presenting feature. During recovery, a significant group mean increase in airflow (FEV1) and static lung volumes was observed with a significant fall in functional residual capacity, but without change in FEV1/forced vital capacity (FVC) ratio. Total lung capacity was unchanged; hence, the mean 0.3-L fall in inspiratory capacity (IC) at day 60 represented a reduction in lung hyperinflation. There was little change in breathing pattern or metabolic parameters. These physiological changes paralleled the improvement in dyspnoea score, with the most improvement occurring within the first 14 days. However, on average, it took 41 days for symptomatic recovery and 40% of patients felt their symptoms had not fully recovered by 60 days.

Conclusion
Improvement in dyspnoea with recovery from a COPD exacerbation is associated with improvement in expiratory flow and reduction in lung hyperinflation rather than a change in breathing pattern or metabolic parameters.

Message
Moderate exacerbations of COPD are associated with worsening lung hyperinflation, while improvement of hyperinflation during recovery is associated with reduction of dyspnoea.

Editorial comment
The importance of lung hyperinflation and the impact it has on symptoms and function has been firmly established over the last few years. After administration of a bronchodilator, reduction of hyperinflation is the mechanism through which most patients with COPD gain benefit. This effect is most pronounced in patients with severe hyperinflation at rest and is independent of changes in measures of airflow. Dynamic hyperinflation during exercise is probably the most important mechanism determining exercise limitation, and therapeutic reduction leads to improvement in functional capacity.

This study illustrates that there is an increase in lung hyperinflation during an acute exacerbation of COPD and that improvement in dyspnoea parallels reduction of hyperinflation during recovery, a change that occurs primarily within the first 14 days. The lack of change in FEV1/FVC strongly suggests that improvement in airflow (FEV1) is a result of volume recruitment and reduction in flow limitation. A similar magnitude of change in IC is seen after bronchodilation, during exercise and during an exacerbation, suggesting a commonality of process.

The study is not without weaknesses, and foremost is the variation in treatment. While providing a picture of "real life", the differences in treatment could potentially affect time course of recovery. In addition, the up to 3-day variation in time of enrolment (baseline measurement) and 25% drop-out by day 30 could have influenced the magnitude of change seen during recovery. However, it seems unlikely that either would significantly alter the overall message of the study.

The study not only advances our knowledge of the physiological change seen during an exacerbation, but illustrates that IC measurement can be accurately performed and used to assess hyperinflation, even during an exacerbation. Ultimately, this provides a measure against which interventions can be assessed and will hopefully allow us to manage more effectively this distressing sequela of the disease.

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Original article