Respiratory physiology: new tools, old concepts

P130 DYNAMIC HYPERINFLATION IS ASSOCIATED WITH A POOR CARDIOVASCULAR RESPONSE TO EXERCISE IN COPD PATIENTS

doi:10.1136/thoraxjnl-2011-201054c.130

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Background Pulmonary hyperinflation has the potential for significant adverse effects on cardiovascular function in COPD. The aim of this study was to investigate the relationship between dynamic hyperinflation and cardiovascular response to maximal exercise in COPD patients.

Methods We studied 48 patients (16F; age 68 yrs ±8; BMI 26±4) with COPD. All patients performed spirometry, plethysmography, Lung diffusion capacity for carbon monoxide (TLco) measurement, and symptom-limited cardiopulmonary exercise test (CPET). The end-expiratory lung volume (EELV) was evaluated during the CPET. Cardiovascular response was assessed by change during exercise in oxygen pulse (ΔO_2 Pulse) and double product, that is, the product of systolic blood pressure and heart rate (DP reserve), and by the oxygen uptake efficiency slope (OUES), that is, the relation between oxygen uptake and ventilation.

Results Patients with a peak exercise EELV (%TLC) ≥75% had a significantly lower resting FEV_1/VC, FEF_{50}/FIF_{50} ratio and IC/TLC ratio, when compared to patients with a peak exercise EELV (%TLC) <75%. Dynamic hyperinflation was strictly associated to a poor cardiovascular response to exercise: EELV (%TLC) showed a negative correlation with ΔO_2 Pulse ($r = -0.476$, p=0.001), OUES ($r = -0.452$, p=0.001) and DP reserve ($r = -0.425$, p=0.004). Furthermore, according to the ROC curve method, the EELV (% TLC) cut-off point which maximised sensitivity and specificity, with respect to a DP reserve value <10 000 as threshold value, was ≥75 % (0.76 sensitivity and 0.80 specificity).

Conclusion The present study shows that COPD patients with dynamic hyperinflation have a poor cardiovascular response to exercise. This finding supports the view that in COPD patients, dynamic hyperinflation may affect exercise performance not only by affecting ventilation, but also cardiac function.

P131 CT EMPHYSEMA SCORE, DYNAMIC HYPERINFLATION AND VENTILATORY EFFICIENCY DURING EXERCISE IN PATIENTS WITH COPD

doi:10.1136/thoraxjnl-2011-201054c.131

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Background Volumetric CT scan is used for evaluating the severity of emphysema in COPD patients. The aim of this study was to ascertain whether volumetric CT scan of emphysema may provide information on dynamic hyperinflation and ventilatory efficiency during exercise in COPD patients.

Methods We studied 20 patients (5 F; age 67 yrs ±9; BMI 26 kg/m^2 ±4) with COPD. All patients performed baseline lung function test, chest CT scan and symptom-limited cardiopulmonary exercise test. Dynamic hyperinflation and ventilatory efficiency were expressed as the end-expiratory lung volume (EELV, in l) at peak exercise and as the slope of the relationship between minute ventilation (l/min) and carbon dioxide production (l/min) during exercise (VE/VCO_2). Oxygen uptake (VO_2, % pred), dyspnoea and leg fatigue perception (VAS in mm/workload in watts) at peak exercise were also measured.

Results In all patients, a wide range of airflow obstruction was found (FEV_1/VC range: 31%–68%). The volumetric CT scan score mean value of emphysema was 32.4%±8.6 (range 15–50%). We found a correlation between CT scan score and VE/VCO_2 ($r=0.511$, p=0.02), peak exercise EELV ($r=0.521$, p=0.03), and peak VO_2 (% pred) ($r=-0.617$, p=0.004). Furthermore, the volumetric CT scan score was related to dyspnoea ($r=0.458$, p=0.04) and leg fatigue perception ($r=0.566$, p=0.009).

Conclusions Our study shows that the presence of emphysema, as assessed by volumetric CT scan, is associated to dynamic hyperinflation and poor ventilatory efficiency during exercise. Additionally, in our patients a reduced aerobic capacity and an increase in dyspnoea and leg fatigue on exertion were associated to high CT score.

P132 COMPARATIVE STUDY OF THE CURVILINEAR ULTRASOUND PROBE (CUP) VS THE LINEAR ULTRASOUND PROBE (LUP) TO MEASURE RECTUS FEMORIS CROSS SECTIONAL AREA (RFCSA)

doi:10.1136/thoraxjnl-2011-201054c.132

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Introduction The use of a LUP has been validated in measuring RFcsa in healthy subjects and COPD patients. A technical concern of this method in obese patients is that although the standard LUP has sufficient resolution it may have an insufficient width window and penetration to measure RFcsa. In contrast, the CUP has sufficient penetration, but insufficient resolution. We hypothesised there would be no difference between RFcsa measured with the LUP and CUP and that the "spliced" RFcsa using the LUP has the same value as the whole RFcsa.

Method Subjects had RFcsa measured at 2/3 of the distance from the anterior superior iliac spine to superior border of the patella. Image acquisition was made using real time B-mode ultrasonography using a 6 MHz linear probe and 2–5 MHz curvilinear probe. Whole and matching "spliced" RFcsa images were acquired in a subgroup. RFcsa measurements were calculated offline using the Image J® programme.

Results 27 subjects (5 COPD patients; 22 healthy subjects) were scanned. Of these, 14 had whole RFcsa images visualised with the LUP. These were compared with RFcsa images obtained using the CUP (Abstract P132 figure 1). There was no difference between the LUP and CUP RFcsa measurements (mean LUP RFcsa 344 (112) mm^2 vs mean CUP RFcsa 364 (110) mm^2; p=ns; intraclass correlation coefficient r=0.95). In addition there was no significant differences between mean "spliced" and whole images (335 (110) mm^2 vs 344 (112) mm^2; p=ns). Three measurements were acquired with each probe with the mean CV of 2.4% and 2.78% for the CUP and LUP, respectively. For the spliced images, the mean CV was 2.5%.