18. Dyspnoea during an incremental ergometer test and respiratory muscle load

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Background: In this study the correlation between dyspnoea and load on the ventilatory muscles was assessed. Both inspiratory and expiratory muscle load were of our interest. This was done in patients with obstructive pulmonary diseases during an incremental maximal exercise test. A subdivision was made between patients with or without a ventilatory exercise limitation. The first was defined as an increase in P_aCO_2 during exercise.

Methods: Fifty patients with a wide range of obstructive pulmonary diseases (FEV_1 %pred.: 66.1 ± 28.8) performed an incremental cycle ergometer test. During the test dyspnoea (Borg), oesophageal pressures, mechanical load on the ventilatory muscles (time tension index (TTI)) and minute ventilation were measured. The amplitude of pleural pressures $(P_i + P_e)_{act}$ generated at W_{max} was multiplied with the breathing frequency (PFP, indication of the muscle load). PFP% was calculated from: frequency × $(P_{i\,act} + P_{e\,act})/(P_{i\,max} + P_{e\,max})$. Linear regression between V_E and PFP at W_{max} was calculated for both groups. The slopes of these relationships give an impression of the length-tension-inappropriateness. When there was a difference in slope it was assessed wether this led to a difference in Borg score for dyspnoea between the two groups. Correlations between the changes in TTI_i, TTI_e, PFP, PFP% and Borg dyspnoea for both groups were calculated.

Results: The slope of V_E/PFP of the non ventilatory limited group was 0.17 l/kPa ($P = 0.007$). The slope of V_E/PFP for the ventilatory limited group was 0.01 L/kP ($P = 0.7$). The difference between the slopes (0.16) was highly significant (CI(0.159–0.161)). However there was no difference between the Borg score for dyspnoea between those groups (mean Borg vent. lim.: 5.9 ± 2.6; mean Borg not vent. lim.: 5.9 ± 2.1; $P = 0.945$). The change in TTI_i was 0.04 ± 0.05 for the ventilatory limited group and 0.07 ± 0.07 for the non ventilatory limited group, which was not significant. The change in TTI_e was 0.08 ± 0.08 and 0.06 ± 0.07 for the ventilatory and the non ventilatory limited group respectively and was also not significant.

Table 1. Correlations (r) between Borg dyspnoea (Bd) and TTI_i, TTI_e, PFP and PFP%, none of the correlations were significant

	Bd			
	TTI_i	TTI_e	PFP	PFP%
Total ($N = 50$)	$r = -0.2272$	$r = 0.0614$	$r = 0.1507$	$r = -0.0013$
Vent. lim. ($N = 22$)	$r = -0.1467$	$r = 0.0652$	$r = 0.1922$	$r = 0.1741$
Nvent. lim. ($N = 28$)	$r = -0.3143$	$r = 0.0619$	$r = 0.1124$	$r = -0.1396$

Conclusions: The sensation of dyspnoea during exercise in patients with obstructive lung disease, did not correlate with parameters of length tension inappropriateness in respiratory muscles. Other parameters of ventilatory muscle load did also not correlate with Borg score for dyspnoea.