

7th International Chronic Obstructive Pulmonary Disease Conference

October 22-23, 2018 | Rome, Italy

Measurements of diaphragmatic mobility in COPD patients

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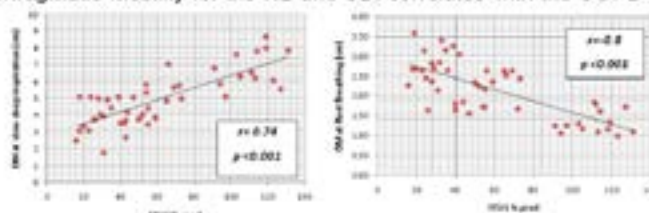
COPD causes airway obstruction that is not fully reversible and causes changes in the rib cage structure. These modifications lead to respiratory muscles functional inefficiency that is strongly correlated to lung function loss. Specifically, the diaphragm undergoes a progressive process of muscle fibers shortening, consequence of lung hyperinflation and dead space increase. This results in a chronic mechanical disadvantage that impairs the diaphragm’s mobility. This impairment may worsen in COPD exacerbations, improving after pulmonary rehabilitation. The diaphragmatic mobility (DM) is mostly assessed with techniques that expose the patient to risks. The ultrasonography in M-mode is easy to use, is safe and measures directly the diaphragmatic dome displacement. The study aimed to determine whether the COPD, according to the subjects’ COPD severity, impairs the DM and to verify DM improvements after an inpatient pulmonary rehabilitation. We performed lung function tests and diaphragmatic M-mode ultrasonography in COPD individuals and healthy subjects. Ultrasonography was performed during rest breathing and deep inspirations. The COPD subjects underwent six-minute walk test and arterial blood gas analysis. After initial screening, 46 COPD patients ended the rehabilitation. The mean characteristics in healthy individuals and COPD subjects: The DM during rest breathing and deep inspirations were correlated to FEV₁ decrease (r=0.74; p<0.01 and r=-0.8; p<0.01, respectively). The correlation was also positive between the deep inspiration and the inspiratory capacity (r= 0.64 with p<0.001). After the rehabilitation, the DM increases during deep inspiration from 4.58cm ± 1.83cm to 5.45cm ± 1.56cm (p<0.01). It could be concluded that M-mode ultrasonography showed DM impairment is correlated to lung function loss in COPD subjects. The patients who completed the rehabilitation improved the diaphragmatic mobility verified during deep inspirations.

Mean values for diaphragmatic mobility according to Lung Function

| | Healthy Controls (n=16) | Moderate COPD (n=6) | Severe COPD (n=13) | Very Severe COPD (n=11) |
|-------------------------|-------------------------|---------------------|--------------------|-------------------------|
| FVC/FEV ₁ | 78±20 | 51.42±6.5 | 43.6±9.5 | 30±4.6 |
| FEV ₁ % pred | 103±30 | 60±7 | 38.5±5.7 | 21.7±4 |
| TLC % pred | 112±19 | 121±10 | 127±30 | 133±24 |
| Rest breathing (cm) | 1.27±0.3 | 2.74±0.7† | 1.95±0.8# | 2.52±0.6† |
| Deep inspiration (cm) | 6.93±1.15 | 5.61±1.6* | 4.4±1.7† | 4.6±2# |

#p=0.002, *p=0.05, †p<0.001, Student T test significance for COPD vs Controls

Diaphragmatic Mobility for the RB and SDI correlates with the COPD severity.



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Recent Publications

1. Corbellini C, Boussuges A, Villafaña J and Zocchi L (2018) Diaphragmatic Mobility Loss in Subjects With Moderate to Very Severe COPD May Improve After In-Patient Pulmonary Rehabilitation. *Resp Care*. 63 (10) 1271-1280.
2. Villafaña J, Corbellini C, Balestri E, Dall'ara S, Bazzochi F, et al. (2017) Functional evaluation of breath: spirometry and body plethysmography comparison in people with cystic fibrosis. *J. Phys. Ther. Sci.* 29: 799-800.
3. Corbellini C, Boussuges A, Villafaña J and Zocchi L (2016) Diaphragmatic mobility improves after pulmonary rehabilitation. A study using M-mode ultrasonography. *European Respiratory Journal* 48:OA3047.
4. Corbellini C, Trevisan C, Villafaña J, Da Costa A and Vieira S R R (2015) Weaning from mechanical ventilation: a cross-sectional study of reference values and the discriminative validity of aging. *J. Phys. Ther. Sci.* 7:1945–1950.

Biography

Camilo Corbellini is a skilled Respiratory Physiotherapist at Casa di Cura Villa Serena Piosasco, Italy, with experience in the treatment and research of respiratory diseases in adult and elderly patients. He graduated in Brazil in 2002. Since 2010, he is studying and working in Italy. He has an MSc in Medical Sciences (Brazil) and in Respiratory Physiotherapy (Italy) and a PhD in Physiology from Milan University.

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