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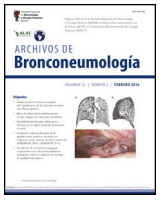

Editorial

Muscle Fatigability of Patients With Severe COPD and Chronic Respiratory Failure: The Contribution of Respiratory Factors

Muscle fatigue can be defined as the temporal decline in the maximal force or power capacity of a muscle. Submaximal contractions can be maintained following the onset of muscle fatigue. Mechanisms such as metabolite accumulation within the myofibers or an inadequate command in the motor cortex are important drivers of muscle fatigue. Mechanisms related to the tasks being performed are also involved in muscle fatigue. In clinical settings, muscle fatigability is usually identified by the reduction in maximal voluntary contraction (MVC) following a fatiguing task performed by a muscle. In healthy subjects, the threshold of the decline of MVC has been established around 15%.[1] In patients with chronic obstructive pulmonary disease (COPD), establishing a threshold of muscle fatigue is not so simple. Patients with severe COPD were not able to attain a certain degree of muscle fatigue during a cycling task as a result of an early interruption of the exercise by dyspnea,[2,3] thus jeopardizing their potential adaptation to training.

Specifically, in patients with severe COPD, during high-intensity endurance exercise (e.g. cycling or walking), the involvement of the central cardiorespiratory component (static and dynamic hyperinflation, mechanical lung constraints, and respiratory muscle fatigability) was demonstrated.[4,5] These factors may precipitate an early interruption of the effort resulting from dyspnea and deconditioning.[4,5] In this context, severe COPD patients may be exposed to a greater susceptibility to experience muscle fatigability resulting from arterial hypoxemia and reduced oxygen delivery.[4,5] In these patients, exercise tolerance may improve in response to oxygen administration, which increases oxygen delivery, reduces the ventilatory requirements for the same workload and the consequent production of lactate.[4,5] Recently, severe COPD patients with chronic respiratory failure on long-term oxygen therapy (LTOT) during a high-intensity exercise showed lower workability with a similar endurance and quadriceps muscle fatigability to severe patients with no chronic respiratory failure.[6] Oxygen supplementation may have played a key role in those results.[6]

In this issue, Paneroni et al.,[7] have explored the contribution of lung function parameters, respiratory muscle strength, and oxygenation status on muscle fatigability following a high-intensity endurance exercise task in severe COPD patients with chronic respiratory failure. The end-point was the decrease in the physiological parameter MVC attained by the study patients after the high-intensity exercise task. A total of 45 patients with COPD and chronic respiratory failure following LTOT were studied in the investigation. They were further subdivided into 20 patients with severe obstruction and 25 patients exhibiting very severe airways obstruction. The authors were able to demonstrate the underlying hypothesis to a large extent. In the investigation, dissimilarities were clearly observed between the two groups of COPD patients from a clinical perspective and their response to exhaustive exercise was also substantially different. Patients exhibiting the most severe airways obstruction were those with greater levels of pulmonary hyperinflation and exercise intolerance, lower inspiratory muscle strength and peripheral muscle fatigability at the peak exercise, probably as a result of increased dyspnea. Following normalization by the work performed by each group of patients, no significant differences in MVC were seen between the two groups. Whether oxygen supplementation may have had an effect on this finding remains to be answered, as both groups of patients were on LTOT.

These are relevant outcomes that show the potential contribution of factors related to respiratory and muscle function to exercise-induced muscle fatigue in severe COPD. Despite the significant findings, several aspects in the study design warrant further attention. The retrospective design (post hoc analysis) adds several concerns, since key contributing factors to increased muscle fatigue could not be investigated.

The involvement of body composition, particularly the status of muscle mass, to increased muscle fatigability should be assessed in severe COPD patients in future studies. The degree of emphysema as measured using imaging techniques and/or diffusion capacity should also be specifically analyzed in future investigations. The use of medications known to affect muscle mass and function such as systemic corticosteroids is another factor that deserves consideration in the field. Furthermore, other aspects such as regular physical activity, adherence to LTOT, and diet may also influence muscle performance and fatigability in patients with severe COPD. The individual analysis of these factors should also be explored in future studies. Assessment of muscle features using functional imaging tools and/or near-infrared spectroscopy (NIRS) or even at the cellular and molecular levels will shed light into the mechanisms that may contribute to increased muscle fatigue in patients with COPD. In this regard, muscle biopsies will represent an asset in this type of investigations. Correlations between muscle phenotype, known to deeply influence muscle function,[8–10] and the profile of patients who are more prone to suffer muscle fatigability should also be analyzed in future investigations.

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Paneroni et al.[7] have clearly shown that severe airways obstruction and hyperinflation along with impaired inspiratory muscle function negatively impact on the peripheral muscles to reach a fatigue threshold in response to high-intensity endurance tasks in patients with severe COPD with chronic respiratory failure. This may be due to the well-known hypothesis of the competence between both muscle groups, peripheral and respiratory muscles. The authors concluded that the influence of the respiratory system component in the early cessation of the exercise cannot be neglected. These findings will have clinical implications in the design of pulmonary rehabilitation programs, particularly in those with chronic respiratory failure. The susceptibility of the patients to suffer greater muscle fatigability should be identified early in clinical settings, as these are the patients whose exercise intolerance may benefit more from a pulmonary rehabilitation program.

Conflict of interests

The authors state that they have no conflict of interests.

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