APSR RESPIRATORY UPDATES

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Inside this issue: Pulmonary Rehabilitation in COPD

Articles selected and commented on by: Prof. **Hajime Kurosawa**, Department of Internal Medicine, Tohoku University School of Medicine , Miyagi, Japan

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Diaphragmatic motor cortex hyperexcitability in patients with chronic obstructive pulmonary disease.

Elnemr R, et al

PLoS One. 2019 Dec 18;14(12):e0217886.

doi: 10.1371/journal.pone.0217886.

Comments: Diaphragmatic dysfunction has been known as one of factors to cause exertional dyspnea in patients with chronic obstructive pulmonary disease (COPD). The dysfunction in COPD is either mechanically secondary to air trapping and hyperinflation or structural muscular injury induced by inspiratory loading induces. Elnemr R, et al. demonstrated that coticospinal pathway affection is a candidate of the third mechanisms using transcranial magnetic stimulation (TMS). The function was reported to be not only affected compared to healthy subjects but also correlated with impaired lung function. The evaluation of coticospinal pathway affection with non-invasive technique of TMS could help in personalization of COPD management especially pulmonary rehabilitation programs. One of concerns would be the reversibility of those affection after therapeutic interventions such as exercise training.

Exercise ameliorates emphysema of cigarette smoke-induced COPD in mice through the exercise-irisin-Nrf2 axis.

Kubo H, et al.

Int J Chron Obstruct Pulmon Dis. 2019 Nov 14;14:2507-2516.

doi: 10.2147/COPD.S226623.

Comments: Myokines, secreted from the muscle during exercise, has known to play a role to prevent onset and progression of various diseases, and prolong survival prognosis. Irisin is one of the myokines of which serum level was significantly lower in patients with COPD than in healthy subjects and that it correlated with physical activity. Using mice model of cigarette smoke-induced COPD, Kubo H, et al reported that the exercise attenuated inflammatory features and decrease mean linear intercept and destructive index of the lung, suggesting amelioration of emphysema. The experiment showed increase of serum irisin level as well as Nrf2 and HO-1 in the lung homogenate in exercise mice. Although they did not show a causal relationship between irisin and Nrf2, their previous study demonstrated the direct irisin-Nrf2 pathway in vitro. These results might support the current hypothesis that Physical activity exerts various favorable functions through secretary activities of skeletal muscles such as myokins.

Most cited articles:

https://onlinelibrary.wiley.com/page/journal/14401843/homepage/mostcited.html

IL13-driven pulmonary emphysema leads to skeletal muscle dysfunction attenuated by endurance exercise.

Balnis J, et al.

J Appl Physiol (1985). 2019 Nov 27.

doi: 10.1152/japplphysiol.00627.2019.

Comments: Patients with chronic obstructive pulmonary disease (COPD) usually develop skeletal muscle dysfunction, which represents a major comorbidity in these patients and is strongly associated with mortality and other poor outcomes. Balnis J, et al. established a transgenic mouse model of COPD based on inducible IL13-driven pulmonary emphysema. In this model, the skeletal muscles developed most features present in COPD patients including atrophy, decreased oxygen consumption, and reduced force-generation capacity. They also showed endurance exercise chronic exercise can partially restore muscle mass, metabolic and force-generation capacity, and SDH activity. Although the mechanisms of those effects were not clearly shown, the results confirmed the importance of exercise for skeletal muscle dysfunction in patients with COPD. The mouse model in this study seems very useful tool to study muscle dysfunction under the condition of various chronic respiratory diseases.

Telomere length in COPD: Relationships with physical activity, exercise capacity, and acute exacerbations.

Wan ES, et al.

PLoS One. 2019 Oct 17;14(10):e0223891.

doi: 10.1371/journal.pone.0223891. eCollection 2019.

Comments: Telomere length such as leukocyte telomere length (LTL) is conceptualized as an integrative summation of an individual's "biological age". Also, the shorter LTL is associated with reduced health-related quality of life and increased risk for acute exacerbations (AEs) and mortality in chronic obstructive pulmonary disease (COPD). Wans ES et al. studied the relationships between LTL and physical activity, exercise capacity, and AEs in 3 well-characterized cohorts of COPD. The results indicated that the longer LTL was associated with increased exercise capacity. Surprisingly, the shorter LTL was associated with increased number of past and future AEs. Although the authors seem to have not given up the possibility of a relationship, they failed to observe association between LTL and physical activity.

Use of pedometers as a tool to promote daily physical activity levels in patients with COPD: a systematic review and meta-analysis.

Armstrong M, et al.

Eur Respir Rev. 2019 Nov 13;28(154). pii: 190039.

doi: 10.1183/16000617.0039-2019.

Comments: Daily physical activity, not exercise, has been shown to be the strongest determinant of survival prognosis in COPD so far. Understanding how to promote daily physical activity through behavioral modification is needed in the primary settings. The most common intervention for that is to use a pedometer, but confirming the actual effect is worth to study. Armstrong M et al. conducted systematic review meta-analysis using internet resource. Improvements in steps per day were found with pedometer physical activity promotion either standalone or alongside pulmonary rehabilitation. Interestingly, they have found further evidence that patients benefit more from physical activity promotion when baseline levels of physical activity are >4000 steps·day^{-1}. It is important to inform clinicians in the primary settings to promote daily physical activity using pedometer in patients with COPD.

Behavioural interventions targeting physical activity improve psychocognitive outcomes in COPD.

Lavoie KL, et al.

ERJ Open Res. 2019 Nov 4;5(4). pii: 00013-2019.

doi: 10.1183/23120541.00013-2019.

Comments: The close relationship between physical activity and the survival prognosis of life in COPD has triggered a greater recognition of the importance of self-management self-management behavior modification (SMBM) programs. Lavoie KL et al. studied the impact of SMBM to improve daily physical activity on psychological and cognitive outcomes in COPD patients. Outcomes included anxiety, depression and cognitive function, which all showed statistically and clinically significant improvements after 12 weeks SMBM with/without bronchodilators and with/without exercise training. The patients who exhibited greater increases in physical activity and exercise capacity had got greater improvements in anxiety and cognitive function, respectively. Depression improved in patients who exhibited increases in either physical activity or exercise capacity. The importance to promote physical activity and exercise capacity was reaffirmed in terms of psychocognitive outcomes.

Determinants of the Diminished Exercise Capacity in Patients with Chronic Obstructive Pulmonary Disease: Looking Beyond the Lungs.

Broxterman RM, et al.

J Physiol. 2019 Dec 19.

doi: 10.1113/JP279135.

Comments: Peak oxygen uptake, a primary determinant of prognosis, mortality, and quality of life, is diminished in patients with COPD. The mechanism assumes a particularly important role for peripheral dysfunction in skeletal muscle. In the paper by Broxterman RM et al., muscle oxygen transport and utilization were assessed at peak effort during exercise, where

ventilation is assumed to be submaximal in patients with COPD and activity-matched controls. During maximal exercise, both convective arterial oxygen delivery to the skeletal muscle microvasculature and subsequent diffusive oxygen delivery to the mitochondria were diminished in patients with COPD, even when ventilatory limitations are minimized by using small muscle mass exercise. These findings emphasize the importance of factors, beyond the lungs, that influence exercise capacity in this patient population and may, ultimately, influence the prognosis, mortality, and quality of life for patients with COPD.

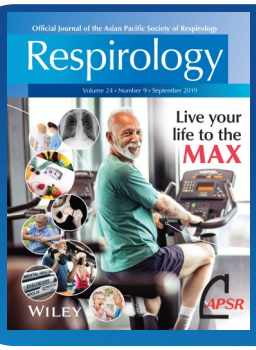
Effect of Virtual Reality-Based Rehabilitation on Physical Fitness in Patients with Chronic Obstructive Pulmonary Disease.

Rutkowski S, et al.

J Hum Kinet. 2019 Oct 18;69:149-157.

doi: 10.2478/hukin-2019-0022.

Comments: Virtual reality (VR) technologies have been explored as a possible adjunct to physical rehabilitation programs as a new challenging intervention. Rutlowski S et al. evaluated the effects of VR-based rehabilitation on physical fitness in patients with COPD. The Xbox 360, commercial video game, and Kinect motion sensor were used to carry out VR training. VR rehabilitation training improved physical fitness in patients with COPD. VR-based rehabilitation seems to be a practical and beneficial intervention capable of enhancing mobility and physical fitness. It is expected that new technologies will continue to be introduced into rehabilitation and will drive new developments.



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Rehabilitation in Chronic Respiratory Diseases

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Physical Activity and Sedentary Behaviour Patterns in 326 Persons with COPD before Starting a Pulmonary Rehabilitation: A Cluster Analysis.

Geidl W, et al.

J Clin Med. 2019 Aug 29;8(9). pii: E1346.

doi: 10.3390/jcm8091346.

Comments: Not only physical activity (PA) but also sedentary behavior (SB) can be a determinant of the major outcomes in patients with COPD. Geidl W et al. conducted a cluster analysis to identify typical PA and SB patterns in patients with COPD before pulmonary rehabilitation. The results revealed four movement clusters with distinct PA and SB patterns: Sedentary non-movers, sedentary occasional movers, sedentary movers, and sedentary exercisers. The four clusters displayed varying levels of moderate PA. In contrast, all four clusters displayed considerably long average sedentary time per day. It was suggested that pulmonary rehabilitation programs should also aim to reduce SB in addition to promoting physical activity.

Home versus outpatient pulmonary rehabilitation in COPD: a propensity-matched cohort study.

Nolan CM, et al.

Thorax. 2019 Oct;74(10):996-998.

doi: 10.1136/thoraxjnl-2018-212765. Epub 2019 Jul 5.

Comments: Providing a home-based exercise to patients with COPD is one of the most fundamental and important aspects of pulmonary rehabilitation. In general, patients who adhere to their prescribed exercises are significantly better at achieving their goals and demonstrate a greater increase in physical function. However, the real-world response has not been studied. Nolan CM et al. compared the effects of the home-based exercise with the conventional exercise under supervision of rehabilitation staff. They found the smaller improvement in exercise capacity with home-based exercise compared with supervised rehabilitation, but similar improvements in quality of life. Home-based exercise might be less effective than the traditional supervised rehabilitation, but could be a valuable alternative for those unable to attend the supervised rehabilitation programs.

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APSR Respiratory Updates is an initiative of the APSR Education Committee

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