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Noninvasive positive airway pressure: from critically ill patients to physical exercise in outpatients

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TO THE EDITOR:

Noninvasive positive airway pressure (PAP) is frequently used in subjects treated in respiratory, emergency, and critical care medicine. Pulmonologists usually remember bilevel PAP (BiPAP) as an important therapeutic option in acute, severe COPD exacerbations (hypercapnic acidosis: pH ≤ 7.35 and $PaCO_2$ > 45 mmHg). In this scenario, BiPAP reduces intubation rate and mortality.[1] Another life-threatening situation treated with continuous PAP (CPAP) is cardiogenic pulmonary edema, which also reduces the need for intubation and mortality.[1]

The use of PAP also presents good results in outpatients. A common indication of home CPAP use is in obstructive sleep apnea patients, reducing daytime sleepiness and risk of traffic accident, as well as improving blood pressure control and quality of life. BiPAP also has a role in outpatients with amyotrophic lateral sclerosis or COPD.[2,3] In amyotrophic lateral sclerosis outpatients, home BiPAP is usually initiated when there are complaints of orthopnea, VC < 50% of the predicted value, or abnormal nocturnal oximetry.[2] In this clinical conundrum, BiPAP has a positive impact in quality of life and survival (median survival increase: ~200 days). Additionally, in stable severe COPD outpatients, home BiPAP decreases readmission and death rates within one year (absolute risk reduction = 17.0%). In this scenario, stable severe COPD outpatients are usually defined as those who had been previously hospitalized who had used BiPAP due to hypercapnic COPD exacerbation and maintained $PaCO_2$ > 53 mmHg, as well as PaO_2 < 55 mmHg (or $PaCO_2$ > 53 mmHg; PaO_2 < 60 mmHg; and oxygen saturation < 90% during > 30% of sleep time, or presented with polycythemia or pulmonary hypertension), 2-4 weeks after hospital discharge.[3]

In the present issue of JBP, a group of authors evaluated the effect of CPAP use in the respiratory function of healthy women (18-40 years old) immersed in water at xiphoid process level.[4] First, it is necessary to emphasize that the immersion in water of the human body causes an increase in venous return, central venous pressure, and pulmonary capillary pressure, as well as a reduction in MIP, MAP, VC, and FEV_1.[4] Consequently, this technique has been used as a model of c*ardiogenic pulmonary edema in the study*.[4] Good results were obtained when the sample of young healthy women immersed in water received CPAP at 10 cmH_2O, reversing the restrictive lung pattern.[4] Therefore, the use of CPAP at that pressure might be beneficial to subjects performing rehabilitation/physical exercise with water immersion. In real life, such subjects generally have osteoarthritis, an aging-related condition. In turn, aging is associated with a higher prevalence of heart failure (HF)—classically manifested as pulmonary edema signs and symptoms. Consequently, CPAP has the potential to reverse reductions in FEV_1 and FVC caused by water immersion in subjects with HF, potentially enabling these subjects to be submitted to the technique in a better way, especially if they have been classified as New York Heart Association functional class IV (not included in previous studies).[5]

The abovementioned idea is based on the fact that PAP reduces respiratory muscle work and exercise-related dyspnea. This occurs due to intrathoracic pressure increase. Furthermore, with respiratory muscle unloading, oxygen supply and demand are balanced, benefiting HF patients during high intensity exercise.[6] In addition, a meta-analysis showed that PAP application before the six-minute walk test in HF patients increased the walking distance.[7]

PAP also appears to improve the cardiac function in HF patients. During a regular cardiac rehabilitation program, acute cardiovascular adjustments occur to supply activated muscles adequately. Resistance exercise training increases ventilatory effort, making inspiratory pleural pressure higher and, consequently, increasing left ventricular (LV) transmural pressure gradient and LV afterload.[8] However, PAP attenuates pleural pressure variations during the effort, reducing LV afterload and improving the heart contractile performance. Another hemodynamic behavior change on PAP use is LV preload decrease (reduction in venous return and a reduction in LV filling). Consequently, LV performance in HF patients is improved.[6]

In conclusion, the potential role of CPAP in rehabilitation/physical exercise programs using water immersion in subjects with HF needs to be further investigated in future studies. We need to remember that, in the study by Rizzetti et al.,[4] subjects with *cardiopulmonary* disease or older than 40 years of age were excluded.

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