pii: jc-19-00559 https://dx.doi.org/10.5664/jcsm.8106

JCSM
Journal of Clinical Sleep Medicine

COMMENTARY

Continuous Positive Airway Pressure and Adaptive Servoventilation in Heart Failure Patients With Central Sleep Apnea With Cheyne Stokes Respiration: Are They Useful in Ameliorating Cardiac Systolic Dysfunction?

Commentary on Schwarz et al. Effect of treatment of central sleep apnea/Cheyne-Stokes respiration on left ventricular ejection fraction in heart failure: a network meta-analysis. *J Clin Sleep Med*. 2019;15(12):1817–1825.

Leonardo Roever, PhD[1]; Gary Tse, PhD[2,3,4]; Giuseppe Biondi-Zoccai, MD, MStat[5,6]

[1]Federal University of Uberlândia, Department of Clinical Research, Xiamen Cardiovascular Hospital, Xiamen, Fujian, P.R., China; [2]Xiamen Cardiovascular Hospital, Xiamen, Fujian, P.R., China; [3]Tianjin Key Laboratory of Ionic-Molecular Function of Cardiovascular Disease, Department of Cardiology, Tianjin Institute of Cardiology, Second Hospital of Tianjin Medical University, Tianjin, P.R. China; [4]The First Affiliated Hospital of Dalian Medical University, Dalian, P.R. China; [5]Department of Medico-Surgical Sciences and Biotechnologies, Sapienza University of Rome, Latina, Italy; [6]Mediterranea Cardiocentro, Napoli, Italy

Cheyne Stokes respiration (CSR) in central sleep apnea (CSA) is characterized by an absence of airflow and inspiratory effort, followed by hyperventilation in an increasing-decreasing pattern. Its presence in heart failure patients is a clear indicator of poor prognosis. Several studies have shown that positive pressure ventilation effectively controls CSA/CSR, with remarkable improvements on several pulmonary endpoints, but there is uncertainty as to whether treatment of CSA/CSR in heart failure is beneficial in terms of quality of life, cardiac function, and cardiovascular outcomes.[1–8]

Continuous positive airway pressure (CPAP) provides constant positive pressure. By contrast, adaptive servoventilation (ASV) provides dynamic adjustment (breath by breath) of the pressure support with a backup rate to normalize breathing patterns relative to a predetermined target (different algorithms in use). ASV can mitigate hyperventilation and associated hypocapnia by providing predefined minute ventilation.[9]

This issue of the *Journal of Clinical Sleep Medicine* boasts a thorough systematic review on this topic, including a total of 24 randomized clinical trials (RCTs) including 1,289 patients, with a relevant subsample of 16 RCTs and 951 patients eligible for inclusion in a network meta-analysis. These selected trials included a very high-risk population with an apnea-hypopnea index (AHI) of 38 ± 3 events/h and left ventricular ejection fraction (LVEF) 29% ± 3%. Compared to an inactive control, both CPAP and ASV significantly improved LVEF by 4.4% and 3.8%, respectively, whereas oxygen supplementation had no effect on LVEF. There was no difference in treatment effects on LVEF between CPAP and ASV. The treatment effect of positive pressure ventilation was larger when baseline LVEF was lower in systolic heart failure.[10] Evidently, these data support more liberal use of CPAP and ASV, with the ultimate goal of improving, on top of LVEF, other important outcomes, including functional class, rehospitalization, and fatality.

Among the limitations of the study, we can highlight the emphasis on patients with predominantly moderate to severe systolic heart failure, as well as the absence of a subgroup analysis of heart failure with preserved ejection fraction (HFpEF) due to the limited number of RCTs in HFpEF. In addition, substantial clinical and statistical heterogeneity was evident at the pairwise-comparison level, whereas confidence intervals for effect on LVEF were quite large. In addition, the exact comparative risk-benefit and cost-benefit profile of CPAP versus ASV remains to be determined, possibly by a large dedicated RCT.

In conclusion, CPAP and ASV are effective for improving LVEF in patients with both heart failure and CSA/CSR. Population-based interventions to encourage the use CPAP and ASV in patients with heart failure and CSA/CSR to improve LVEF are direly needed. Further research is needed to determine the economic implications of implementing such programs.

CITATION

Roever L, Tse G, Biondi-Zoccai G. Continuous positive airway pressure and adaptive servoventilation in heart failure patients with central sleep apnea with Cheyne Stokes respiration: are they useful in ameliorating cardiac systolic dysfunction? *J Clin Sleep Med*. 2019;15(12):1715–1716.

REFERENCES

1. Randerath W, Verbraecken J, Andreas S, et al. Definition, discrimination, diagnosis and treatment of central breathing disturbances during sleep. *Eur Respir J*. 2017;49(1):1600959.
2. Arzt M, Oldenburg O, Graml A, et al. Phenotyping of sleep-disordered breathing in patients with chronic heart failure with reduced ejection fraction-the SchlaHF registry. *J Am Heart Assoc*. 2017;6(12).

3. Roever L, Quan SF. Prevalence of sleep disordered breathing symptoms and risk factors for chronic diseases: are there differences in countries of high and low income? *Sleep*. 2015;38(9): 1349–1350.
4. Wallström S, Balcan B, Thunström E, Wolf A, Peker Y. CPAP and health-related quality of life in adults with coronary artery disease and nonsleepy obstructive sleep apnea in the RICCADSA trial. *J Clin Sleep Med*. 2019;15(9):1311–1320.
5. Perger E, Inami T, Lyons OD, et al. Distinct patterns of hyperpnea during Cheyne-Stokes respiration: implication for cardiac function in patients with heart failure. *J Clin Sleep Med*. 2017;13(11):1235–1241.
6. Ramar K, Ramar P, Morgenthaler TI. Adaptive servoventilation in patients with central or complex sleep apnea related to chronic opioid use and congestive heart failure. *J Clin Sleep Med*. 2012;8(5):569–576.
7. Macdonald M, Fang J, Pittman SD, White DP, Malhotra A. The current prevalence of sleep disordered breathing in congestive heart failure patients treated with beta-blockers. *J Clin Sleep Med*. 2008; 4(1):38–42.
8. Krachman SL, Nugent T, Crocetti J, et al. Effects of oxygen therapy on left ventricular function in patients with cheyne-stokes respiration and congestive heart failure. *J Clin Sleep Med*. 2005;1(3):271–276.
9. Aurora RN, Chowdhuri S, Ramar K, et al. The treatment of central sleep apnea syndromes in adults: practice parameters with an evidence-based literature review and meta-analyses. *Sleep*. 2012;35(1):17–40.
10. Schwarz EI, Scherff F, Haile SR, et al. Effect of treatment of central sleep apnea/Cheyne-Stokes respiration on left ventricular ejection fraction in heart failure: a network meta-analysis. *J Clin Sleep Med*. 2019;15(12):1817–1825.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication October 9, 2019
Submitted in final revised form October 9, 2019
Accepted for publication October 9, 2019
Address correspondence to: Leonardo Roever, Federal University of Uberlândia, Rafael Rinaldi 431, Uberlândia, Minas Gerais 38400384, Brazil; Tel: +5534988039878; Email: leonardoroever@hotmail.com

DISCLOSURE STATEMENT

The authors report no conflicts of interest.