Positive Airway Pressure for Sleep Apnea in Advanced Heart Failure

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An 88-year-old male was referred to the Sleep Clinic for evaluation. He reported loud snoring with witnessed apneas, fragmented sleep, morning headaches, and excessive daytime sleepiness. His average sleep duration was less than eight hours each night, and he was taking multiple unintentional naps throughout the day. His Epworth Sleepiness score was 15.

The patient was a former smoker. He reported no history of caffeine intake. His medical history included gastroesophageal reflux disease, open-angle glaucoma, hypertension, hyperlipidemia, atrial fibrillation, coronary artery disease (CAD), CABG, mitral valve replacement, sick sinus syndrome, and pacemaker insertion. His transthoracic echocardiogram was remarkable for mild concentric left ventricular hypertrophy, mild septal hypokinesis, and a left ventricular ejection fraction of 50 to 55 percent.

On physical examination, vital signs were normal and his BMI was 26.62. The exam was remarkable for a Mallampati class III airway. The remainder of the physical examination was unremarkable.

The patient had a home sleep study that showed severe obstructive sleep apnea with an apnea-hypopnea index (AHI) of 46/hour. He could not tolerate PAP therapy and opted for oral appliance therapy. Follow-up home sleep study with the oral appliance showed an AHI of 42/hour. Cheyne-Stokes Respiration (CSR) was present during 88 percent of the time monitored (Figure A).

How should we treat this patient with CSA and CSR?

Central sleep apnea (CSA) with periodic breathing, also known as Cheyne-Stokes Respiration (CSR), is commonly seen in patients with heart failure. It is characterized by episodes of hyperventilation followed by apnea or hypopnea and oxygen desaturation. Central sleep apnea has been shown to be an independent predictor of a poor prognosis and death in patients with heart failure. Intermittent hypoxia and arousal, with an increase in sympathetic tone, has been thought to be the mechanism for worsening cardiac function in CSA. Adaptive servo-ventilation (ASV) is a modality that works by providing servo-controlled inspiratory pressure support, in addition to the expiratory positive airway pressure. It has been the treatment of choice for CSA until recently when the results of the SERVE-HF trial were reported[1].

SERVE-HF was a multicenter randomized controlled trial that investigated the effects of ASV in patients who had heart failure with an ejection fraction of 45 percent or less, and predominantly CSA.

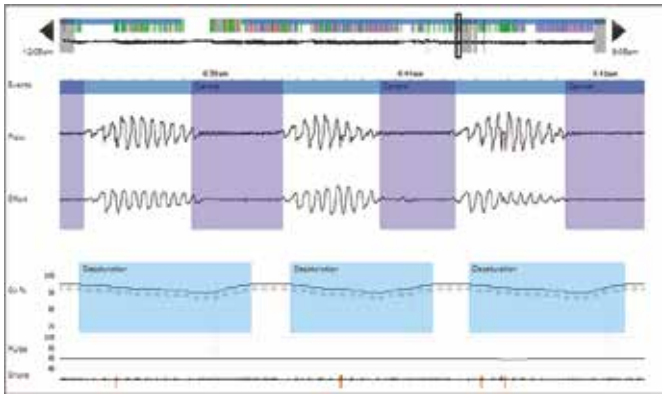

Figure A . *Cheyne-Stokes Respiration, characterized by episodes of hyperventilation followed by apneas with the decrease in oxygen saturation.*

This study was concluded at the first event of death from any cause, lifesaving cardiovascular intervention (cardiac transplantation, implantation of a ventricular assist device, resuscitation after sudden cardiac arrest, or appropriate lifesaving shock) or unplanned hospitalization for worsening heart failure.

There was no significant effect of ASV at the conclusion of this study. Surprisingly, the all-cause mortality and cardiovascular mortality at 12 months was significantly higher in the ASV group than in the control group. The reason for this unexpected increase in mortality is not currently known despite multiple hypotheses. Based on these findings, we have to reconsider the clinical practice of using ASV in patients with CSA and heart failure with *reduced ejection fraction*.

It is important to emphasize that these results are not applicable to patients with CSA due to heart failure with preserved ejection fraction, opioid use or stroke, and patients with predominantly obstructive sleep apnea regardless of the ejection fraction.

The patient presented in the case above, has heart failure with preserved ejection fraction. Given the patient's symptoms and severity of sleep apnea with predominantly CSR, he underwent positive airway pressure titration with ASV which led to successful abolition of CSR. The patient has since been using the ASV with significant clinical improvement.

Reference:

1. Cowie, M. R., H. Woehrle, et al. (2015). "Adaptive Servo-Ventilation for Central Sleep Apnea in Systolic Heart Failure." N Engl J Med 373(12): 1095-1105.