Central Sleep Apnea, Cheyne-Stokes Respirations and Adaptive Servo Ventilation – What Do We Do Now? By Robert L. Owens MD, UCSD Division of Pulmonary, Critical Care and Sleep Medicine

- Both obstructive and central sleep apnea are extremely common in patients with congestive heart failure.
- Cheyne-Stokes Respiration (CSR) portends a poor prognosis, even in the modern era of therapy.
- Treatment of CSR should be optimal medical management of heart failure, if possible.
- Continuous positive airway pressure can treat CSR in some patients, and may slightly improve cardiac function, although there is not a consistent benefit in mortality.

Adaptive servo ventilation (ASV) effectively suppresses CSR, however its use in those with a reduced ejection fraction $\leq 45\%$ was associated with an increase in sudden cardiac death and its routine use in this patient population cannot be recommended at this time.

Patients already treated with ASV and reduced EF should be evaluated by their providers. Continuation of therapy may be reasonable if patients are symptomatically improved, and understand the potential risks and benefits. These patients may require ongoing follow-up as more data become available.

Many physicians were surprised to receive a “Field Safety Notice” from ResMed, Inc. on May 13$^{th}$, 2015 that cautioned against using adaptive servo ventilation (ASV) in patients with heart failure reduced ejection fraction (HFrEF) and central sleep apnea. The study showed no difference in its primary composite outcome of all-cause mortality and unplanned hospitalizations, however, there was an increase in annual cardiovascular mortality of 10% ASV vs. 7.5% no ASV (HR=1.34, 1.07-1.67, p=0.010). The increase in cardiovascular mortality is thought to be due to an increase in sudden cardiac death, although analysis is ongoing.

First, some background about central sleep apnea in heart failure and ASV. Cheyne-Stokes respiration (CSR), is a form of central sleep apnea characterized by a waxing and waning pattern of breathing, with periods of hyperventilation and arousal alternating with central apneas. CSR has been reported in up to 30% of patients with CHF, although prevalence estimates vary widely based on the population studied and heart failure treatment. CSR was originally described as an ominous sign portending impending death. More recent studies have continued to identify CSR as a predictor of increased mortality in patients with systolic heart failure. One explanation for this observation is that CSR itself may exacerbate heart failure, by causing intrathoracic pressure swings and repetitive surges in catecholamines throughout the night.

If this latter hypothesis is true, then treatment of CSR should help prevent further decline in cardiac function. Continuous positive airway pressure (CPAP) has been used as a treatment for CSR in heart failure patients. In this case, CPAP likely stabilizes breathing by increasing cardiac output in those with reduced cardiac function presumably through effects on both preload (by decreasing venous return to the chest) and afterload (by decreasing cardiac transmural pressure).
However, studies of CPAP in CSR associated with heart failure have not been uniformly positive. The largest, the Canadian Continuous Positive Airway Pressure Trial for Congestive Heart Failure Patients with Central Sleep Apnea (CANPAP) found improvements in morbidity and mortality only in the ‘responder’ subgroup whose CSR actually improved on CPAP.

Adaptive servo ventilation (ASV) is a mode of non-invasive ventilation in which ventilation is provided during periods of apnea, while little or no ventilatory support is provided during spontaneous breathing. The effect is to reduce under- and overshoots in ventilation that perpetuate periodic breathing. ASV is very effective at greatly reducing or eliminating CSR.

So why doesn’t it work? As of yet, there is no clear explanation for the observed increase in cardiovascular mortality. However, the effects of PAP on cardiac output are dependent on volume status – that is, PAP therapy could further reduce cardiac output in some patients. Alternatively, ASV may actually be beneficial but results in changes in lifestyle (increased physical activity) or medications (e.g. lower doses of beta-blockers) that might contribute to increased risk of cardiac death. We await further analysis of the data, and the results of other ongoing studies. For now, ASV cannot be recommended for patients with reduced ejection fraction and CSR. Patients already treated with ASV should be evaluated by their providers to decide whether to continue with this therapy although it may be reasonable to continue ASV in those patients who are symptomatically improved if the patients understand the potential risks and benefits.

References
