Adaptive pressure support servo-ventilation: a novel treatment for Cheyne-Stokes respiration in heart failure.

Teichner X, Dotting J, Wang YF, Sontz-Jones M
Dallas VA Medical Center, University of Texas Southwestern Medical Center, Dallas, TX, USA.

Adaptive servo-ventilation (ASV) is a novel method of ventilatory support designed for treatment of Cheyne-Stokes respiration (CSR) in heart failure. The aim of our study was to compare the effect of one night of ASV vs. sleep and breathing with the effect of other treatments. Fourteen subjects with stable cardiac failure and receiving optimal medical treatment were tested untreated and on five treatment nights in seven different modalities: nasal oxygen, CPAP at 5 cm H2O, continuous positive airway pressure (CPAP) at 10 cm H2O, bilevel CPAP at 5-10 cm H2O, bilevel CPAP at 5-10 cm H2O with ASV, and ASV. The mean age was 60±5 yrs and the median body mass index (BMI) was 28 kg/m2.

All subjects (age 28-80 years, NYHA: II-IV) with stable CHF and CSA-CSR were randomised to either CPAP or ASV. At inclusion both groups were comparable for NYHA class, LVEF, ... At 6 months, the improvement in quality of life was higher with ASV and only ASV induced a significant increase in LVEF.

Conclusion: These results suggest that patients with CSA-CSR might receive greater benefit from treatment with ASV than with CPAP.

Heart Failure and Central Sleep Apnea/ Cheyne-Stokes Respiration

Sleep-disordered breathing (SDB) is known to have serious cardiovascular consequences. Research indicates that up to 70% of patients with heart failure have some form of SDB, either obstructive sleep apnea (OSA) or central sleep apnea (CSA). Furthermore, heart failure patients with CSA also often exhibit a form of periodic breathing, known as Cheyne-Stokes respiration (CSR) in heart failure. This novel therapy utilizes adaptive servo-ventilation (ASV) and has demonstrated the ability to improve clinical outcomes and quality of life in heart failure patients.
Circulation 1999; 99(11):1435-1440

Prognostic value of nocturnal Cheyne-Stokes respiration in chronic heart failure.

Lanfranchi PA, Braghiroli A, Bosimini E, Mazzuero G, Colombo R, Conner CF, Giannuzzi P.

Division of Cardiology, Department of Bioengineering, Salvatore Maugeri Foundation, IRCCS, Veruno, Italy. lanfranchi@fsm.it

BACKGROUND: Nocturnal Cheyne-Stokes respiration (CSR) occurs frequently in patients with chronic heart failure (CHF), and it may be associated with sympathetic activation. The aim of the present study was to evaluate whether CSR could affect prognosis in patients with CHF.

METHODS AND RESULTS: Sixty-two CHF patients with left ventricular ejection fraction \( \leq 35\% \), in NYHA class II to III, underwent clinical evaluation, Doppler echocardiography, ergospirometry, pharyngolaryngeal test, Holter recording, and a sleep study to evaluate the occurrence of CSR, expressed as percentage of periodic breathing, and apneas-hypopneas index (AHI) in the number of apneas and hypopneas per hour of recording. During a mean follow-up of 26±13 months, 16 patients died of cardiac causes. Nonsurvivors were in a higher NYHA functional class than survivors (P<0.001) and had a more depressed left ventricular ejection fraction (P<0.001), a shorter desaturation time of early falling (P<0.05), larger left and right atria (P<0.001 and P<0.02, respectively) and a lower peak VO2 (P<0.05). Nonsurvivors also spent a greater percentage of the night in periodic breathing (P<0.001) with a greater AHI (P<0.001) and showed lower values of arterial desaturation sensitivity (P<0.001) and of heart rate variability (P<0.001). Multivariate analysis revealed that survival was negatively correlated with CSR, NYHA class index, and the amount of stage 12 non-REM sleep and was inversely related to the total sleep time who conclude that mortality is higher in CHF patients who develop CSR during sleep than in CHF patients without CSR. Although the development of CSR may simply reflect more severe cardiac impairment, we suggest that CSR itself accelerates the deterioration in cardiac function.

CONCLUSIONS: The AHI is a powerful independent predictor of poor prognosis in clinically stable patients with CHF. The presence of CSR in CHF is associated with worse cardiac prognosis compared with other clinical, echocardiographic, and autonomic data and identifies patients at very high risk for subsequent cardiac death.

Reprinted with permission.


Increased mortality associated with Cheyne-Stokes respiration in patients with congestive heart failure.

Hanly PJ, Zuberi-Khokhar NS.

Department of Medicine, Wellesley Hospital, University of Toronto, Canada.

We hypothesised that mortality is higher in patients with congestive heart failure (CHF) who develop Cheyne-Stokes respiration (CSR) during sleep than in patients without CSR. Overnight polysomnography was performed on 16 male patients with chronic, stable CHF, nine had CSR during sleep (CSR group) and seven did not (control group). The CSR group had a higher apneas-hypopneas index (AHI): 41 ± 17 versus 6 ± 8/hr and experienced greater sleep disruption. There were no significant intergroup differences between age, weight, cardiac function, and pulmonary function. After the initial sleep study, all patients were maintained on standard medical therapy for CHF with supplemental oxygen or nasal continuous positive airway pressure. Over the next 2 to 4 years there was a significant difference between the number of deaths in each group. Five patients died in the CSR group and two remained alive. Kaplan-Meier analysis revealed that mortality was positively correlated with CSR, NYHA class index, and the amount of stage 12 non-REM sleep and was inversely related to the total sleep time. We conclude that mortality is higher in CHF patients who develop CSR during sleep than in CHF patients without CSR. Although the development of CSR may simply reflect more severe cardiac impairment, we suggest that CSR itself accelerates the deterioration in cardiac function.

Cumulative survival in the CSR and CHF groups, which was significantly lower in the CSR group (p = 0.0419).

Reprinted with permission.

A randomised controlled trial of adaptive ventilation for Cheyne-Stokes breathing in heart failure.

Pepperell JC, Maskell NA, Jones DR, Langford-Wiley BA, Crosthwaite N, Stradling JR, Davies RJ.

Oxford Sleep Unit, Oxford Centre for Respiratory Medicine, Oxford Radcliffe Hospital, Oxford, United Kingdom.

Heart failure is associated with Cheyne-Stokes breathing, which fragments patients’ sleep. Correction of respiratory disturbance may reduce sleep fragmentation and excessive daytime sleepiness. This randomised prospective parallel trial assesses whether nocturnal adaptive ventilation improves daytime sleepiness compared with control. A total of 56 subjects (81 males) with Cheyne-Stokes breathing (mean apneahypopnea index 18.0 (SD 2.6) and stable symptomatic chronic heart failure (New York Heart Association: Class II to III) were treated with 1 month’s therapy using 18 hours of subtherapeutic adaptive ventilation. Daytime sleepiness (Epworth test) was measured before and after the trial with change in measured sleepiness the primary endpoint. Secondary endpoints included brain natriuretic peptide (BNP) levels and daytime sleepiness. Adaptive treatment reduced excessive daytime sleepiness; the mean Epworth change was 7.9±6.0 minutes (SEM 2.0), which compared well with the control; the change was -1.9±9.6 minutes (SEM 3.7) and the difference was 9.8±5.6 minutes (95% confidence interval 3.9 to 15.7 minutes, p = 0.003, unpaired t-test). Significant falls occurred in plasma brain natriuretic peptide and urinary norepinephrine excretion. We conclude that adaptive ventilation produces an improvement in excessive daytime sleepiness in patients with Cheyne-Stokes breathing and chronic heart failure. This study suggests improvements in neurohumoral activation with