

# Effect of Auto Servo-Ventilation (ASV) and Continuous Positive Airway Pressure (CPAP) on B-type natriuretic peptide (NT-proBNP) in patients with co-existing Obstructive (OSA) and Central Sleep Apnea (CSA) in Heart Failure (HF)

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## Background

The coexistence of obstructive (OSAS) and central sleep apnoea (CSA), and Cheyne-Stokes respiration (CSR) is common in patients with heart failure (HF). CPAP improves CSA/CSR by about 50%. However, maximal suppression of CSA is important in improving clinical outcomes in HF patients. Echocardiography and O<sub>2</sub> uptake capacity are useful tests to assess those outcomes, as is B-type natriuretic peptide (NT-proBNP), an established blood parameter indicative of HF. Adaptive servo-ventilation (ASV) effectively suppresses CSA/CSR in HF, but only few trials have been performed in coexisting OSAS and CSA/CSR.

We therefore compared the efficacy of a new ASV device, the BiPAP AutoSV®, with CPAP in HF patients with coexisting sleep disordered breathing.

## Methods

**Design:** Randomized, controlled study of ASV vs. CPAP over twelve months.

**Inclusion criteria:** Coexisting OSAS and CSA/CSR, arterial hypertension, coronary heart disease or cardiomyopathy and clinical signs of heart failure NYHA II-III.

**Groups:** CPAP: n = 34 (32 m, 2 f, AHI 40.9 ± 17.1/h, BMI 30.3 ± 4.8 kg/m<sup>2</sup>, age 67.4 ± 8.1 y, pressure 10.4 ± 1.0 mbar) ASV: n = 36 (31 m, 5 f, AHI 46.8 ± 23.6/h, BMI 32.2 ± 6.8 kg/m<sup>2</sup>, age 65.3 ± 10.0 y., minimal inspiratory pressure IPAP<sub>min</sub> 9.2 ± 2.2 mbar, IPAP<sub>max</sub> 18.0 ± 2.5 mbar, expiratory pressure EPAP 8.6 ± 2.0 mbar).

**Device:** BiPAP autoSV® device (Respironics, Murrysville, Pennsylvania, USA) used in CPAP or ASV mode. CPAP 10 mbar.

**Measurements:** Polysomnographic and cardiac parameters were measured at baseline and after 3 and 12 months. NT-proBNP was assessed via electrochemiluminescence immunoassay.

**Analysis:** Data of patients who used their device during the whole period were analyzed (26 ASV, 25 CPAP). For further analysis, patients were divided into responders (AHI < 10/h and < 50% below baseline AHI) and non-responders. Mann-U-Whitney test for comparisons between the groups, Wilcoxon's matched-pairs test for comparisons between baseline and post-intervention examinations. Significance level at 0.05.

## Results

- 50% central disturbances in both groups at baseline.
- Significant improvement in all types of respiratory disturbances and arousals with both treatment options.
- BiPAP autoSV reduced the central AHI and NT-proBNP levels and improved VO<sub>2</sub>max significantly more effectively as compared to CPAP.
- Tendency to better improvement of total AHI with BiPAP autoSV
- Lower BNP levels in therapy responders after 12 Months.

Tab. 1: Baseline vs. 12 months treatment (# p<0.05, ## p<0.01, ### p<0.001), CPAP vs. BiPAP autoSV (\* p<0.05, \*\* p<0.01). Values are mean ± SD.

	CPAP		BiPAP	
	Baseline	12 Months	Baseline	12 Months
AHI total (/h)	41,6 ± 15,4	11,4 ± 9,6 ###	48,0 ± 25,0	6,9 ± 7,2 ###
AHI central (/h)	23,4 ± 12,8	9,1 ± 8,2 ###	24,9 ± 14,7	3,3 ± 2,6 * ###
AHI obstr. (/h)	11,1 ± 6,7	1,5 ± 2,2 ###	16,6 ± 10,6	3,3 ± 5,3 * ###
Snoring (min)	112,4 ± 74,2	27,4 ± 57,4 ###	84,3 ± 72,2	20,4 ± 31,1 #
SaO <sub>2</sub> min (%)	75,1 ± 13,0	87,5 ± 4,5 ###	72,8 ± 17,5	87,2 ± 7,3 ###
SaO <sub>2</sub> mean (%)	91,8 ± 2,7	94,2 ± 3,2 ##	91,2 ± 3,5	94,6 ± 1,9 ###
SaO <sub>2</sub> < 90% (min)	21,8 ± 25,1	2,5 ± 8,5 ###	23,0 ± 28,0	3,0 ± 5,9 ###
Arousal total	32,6 ± 16,8	19,3 ± 13,6 ##	32,6 ± 19,3	20,9 ± 14,8 #
Arousal resp.	17,2 ± 13,4	2,0 ± 2,4 ###	17,7 ± 19,9	3,3 ± 4,6 ##
TST (min)	345,7 ± 61,5	286,4 ± 74,8 ###	314,9 ± 72,9	280,9 ± 61,7
REM (%TST)	16,7 ± 9,9	17,0 ± 9,2	12,9 ± 7,4	14,4 ± 7,5
S1+S2 (%TST)	73,0 ± 12,8	61,4 ± 8,9 ##	72,5 ± 13,1	66,0 ± 14,4
S3+S4 (%TST)	11,5 ± 10,5	21,7 ± 9,9 ###	14,5 ± 10,6	19,6 ± 11,6
NT-proBNP (ng/L)	687 ± 979	876 ± 1882	537 ± 892	241 ± 315 *
LVEF (%)	43,2 ± 16,4	48,1 ± 11,9	47,4 ± 15,8	45,5 ± 16,0
VO <sub>2</sub> max (L/min)	1,49 ± 0,30	1,49 ± 0,31	1,76 ± 0,48 *	1,82 ± 0,35 **

Tab. 2: Cardiac parameters, baseline vs. 12 months treatment, comparison between responders and non-responders. Values are mean ± SD.

	Responder		Non-Responder	
	Baseline	12 Months	Baseline	12 Months
Count	32 (19 ASV, 13 CPAP)		19 (7 ASV, 12 CPAP)	
NT-proBNP (ng/L)	517 ± 813	214 ± 236	768 ± 1104	1016 ± 2121
LVEF (%)	46,6 ± 17,0	46,9 ± 13,1	43,6 ± 14,9	46,6 ± 15,6
VO <sub>2</sub> max (L/min)	1,66 ± 0,47	1,73 ± 0,29	1,58 ± 0,33	1,54 ± 0,45

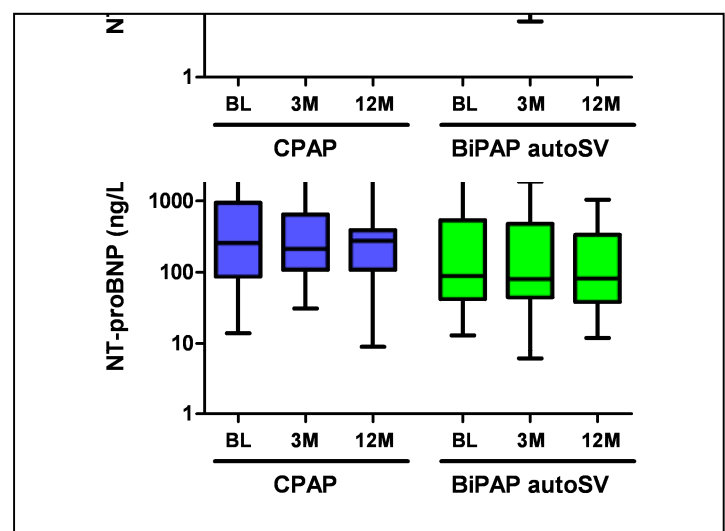


Fig. 1: NT-proBNP levels at baseline (BL), 3 months (3M) and 12 months (12M) in BiPAP autoSV and CPAP groups. (Whiskers: min. to max.)

## Conclusions

- BiPAP autoSV and CPAP are effective options for the treatment of patients with coexisting central and obstructive disturbances.
- BiPAP autoSV is superior in the improvement of central respiratory disturbances both over the short and long term.
- Effective treatment of co-existing OSA and CSA with ASV improves NT-proBNP levels, suggesting a relief of cardiac load. This may be related to a more efficient reduction of central disturbances in this group of patients compared to CPAP.