Supplementary file

Methods

Measurements

--Body fluid balance and body composition

The body composition of each participant was examined using a bioelectrical impedance analysis (BIA) instrument (Inbody s20, BIOSPACE, Seoul, South Korea) in the morning after polysomnography at baseline and follow-up. This was also after a 12 hour fast. This is a multi-frequency impedance plethysmograph body composition analyser, which takes readings from the body using eight-point tactile electrodes, of which two are in contact with the thumb and middle finger of each hand, and two are in contact with the bilateral sides of the ankle joint of each foot. After resistance was measured at five specific frequencies (1kHz, 50kHz, 250kHz, 500kHz, and 1MHz), the amount of total body water and extracellular water were estimated from these data. Fat mass and lean fat mass were estimated by total body water through proprietary algorithms. Participants were instructed to recline for at least 5 minutes before analysis and to lie quietly during analysis.

To confirm the reproducibility of the data, we measured the above parameters three times in 10 minutes (each measurement required 1–2 minutes) for every participant and calculated intra-class correlation coefficient (ICC) values for all variables measured. The ICC values for agreement were greater than 0.99 for all parameters measured. For all parameters, we adopted the average value of the last two measurements for data analysis.

Supplementary table 1. Sleep parameters at baseline and after three months of therapy: full analysis set.

	ASV (n=19)	Oxygen (n=21)	p*
Total sleep time, m			
Baseline	325.8±72.7	320.5±64.1	0.81
3 months	337.2±53.4	342.9±62.9	
Δ	11.4±61.9	22.4±67.4	0.59
Obstructive apnea hypopnea index, /h			
Baseline	5.4±5.2	10.1±10.3	0.26
3 months	0.9±1.5†	7.1±7.1	
Δ	-4.5±6.0	-3.0±8.9	0.55
Central apnea hypopnea index, /h			
Baseline	28.8±12.9	26.8±11.8	0.60
3 months	6.3±5.2†	12.3±7.7†	
Δ	-22.6±11.1	-14.5±11.1	0.03
Time SpO_2<90%, m			
Baseline	41.4±63.8	60.0±52.7	0.11
3 months	0.8±1.6†	3.3±7.0†	
Δ	-40.6±63.3	-56.7±64.4	0.43
Arousal Index, /h			
Baseline	42.3±2.2	36.7±12.6	0.33
3 months	27.7±15.6†	24.2±9.5†	
Δ	-14.6±14.7	-12.5±14.4	0.66

Values are expressed as mean ± standard deviation.

* p value for comparisons of changes in the parameters between the two groups.

† $p<0.05$ vs baseline within the same group.

Supplementary table 2. Clinical background of study participants：per protocol analysis set.

	ASV (n=15)	Oxygen (n=18)	p
Male, n(%)	13 (86.7)	14 (77.8)	0.67
Age, y	67±10	71±6	0.32
Body mass index, kg/m^2	23.1±3.1	24.4±2.3	0.16
NYHA classification (I/II/III), n	0/10/5	1/13/4	0.50
Main etiology of heart failure			
Old myocardial infarction, n(%)	6 (40.0)	10 (55.6)	
Dilative cardiomyopathy, n(%)	9 (60.0)	6 (33.3)	
Hypertrophic cardiomyopathy, n(%)	0 (0)	1 (5.6)	
Sarcoidosis, n(%)	0 (0)	1 (5.6)	0.25
History of atrial fibriration, n(%)	3 (20.0)	3 (16.7)	1.00
Medication			
β-blocker, n(%)	12 (80.0)	16 (88.9)	0.64
Diuretics, n(%)	7 (46.7)	8 (44.4)	0.90
Ca-blocker, n(%)	2 (13.3)	3 (16.7)	1.00
ACEI/ARB, n(%)	11 (73.3)	15 (83.3)	0.67
Amiodarone, n(%)	2 (13.3)	1 (5.6)	0.58
Implanted biventricular pacemaker or	4 (26.7)	3 (16.7)	0.67
NT-proBNP, pg/ml	583 (319 - 1720)	447 (215 - 1046)	0.21
Apnea hypopnea index, /h	34.4±13.3	38.2±9.5	0.34
Central / Total aponea hyponea index, %	81.4±16.7	71.7±27.7	0.24
3% oxygen desaturation index, /h	29.5±14.9	34.2±11.4	0.32

Values are expressed as mean ± standard deviation or median (1st quartile – 3rd quartile).

ASV, Adaptive servo ventilation; NYHA, New York Heart Association; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker;

NT-proBNP, N-terminal-pro-B-type natriuretic peptide.

Supplementary table 3. Echocardiographic parameters at baseline and three months follow-up: per protocol analysis.

	ASV (n=15)	Oxygen (n=18)	p*
Left ventricular ejection fraction, %			
Baseline	35.8±10.8	38.0±9.3	0.53
3 months	36.3±12.9	39.2±10.5	
Δ	0.5±4.7	1.1±5.1	0.69
Left ventricular end-diastolic diameter, mm			
Baseline	60.0±9.4	60.0±7.7	0.97
3 months	59.7±9.2	59.7±9.5	
Δ	-0.2±2.7	-0.4±3.1	0.87
Left ventricular end-systolic diameter, mm			
Baseline	49.9±10.8	50.0±10.0	0.96
3 months	49.3±11.5	49.1±12.5	
Δ	-0.6±2.7	-0.9±4.0	0.81
Left ventricular end-diastolic volume, ml			
Baseline	177.7±63.0	151.8±59.7	0.24
3 months	170.7±54.7†	164.4±77.5	
Δ	-7.1±13.9	12.6±31.4	0.04
Left ventricular end-systolic volume, ml			
Baseline	115.0±61.9	98.8±56.9	0.44
3 months	112.8±55.4	105.3±65.0	
Δ	-2.2±12.1	6.4±23.6	0.21
Left atirum diameter, mm			
Baseline	44.6±7.1	45.7±6.7	0.64
3 months	45.7±6.6	46.0±5.6	
Δ	1.1±2.6	0.3±3.4	0.47

Values are expressed as mean ± standard deviation.

ASV, adaptive servo ventilation.

* p value for comparison between ASV and oxygen groups.

† $p<0.10$ vs baseline within the same group.

Supplementary table 4. Sleep parameters at baseline and after three months of therapy: per protocol analysis set.

	ASV (n=15)	Oxygen (n=18)	p*
Total sleep time, m			
Baseline	333.8±74.7	324.8±67.4	0.72
3 months	344.1±53.8	350.9±63.3	
Δ	10.2±66.3	26.1±68.7	0.51
Obstructive aponea hypopnea index, /h			
Baseline	5.9±5.6	11.0±10.9	0.11
3 months	0.7±1.3†	7.8±7.5	
Δ	-5.2±6.3	-3.2±9.6	0.49
Central aponea hypopnea index, /h			
Baseline	28.5±14.3	27.3±12.1	0.78
3 months	6.7±5.7†	11.7±7.1†	
Δ	-21.8±12.1	-15.5±11.7	0.14
Time SpO_2<90%, m			
Baseline	36.1±53.5	49.3±52.2	0.48
3 months	0.8±1.7†	3.7±7.5†	
Δ	-35.3±52.6	-45.6±54.2	0.58
Arousal Index, /h			
Baseline	41.4±20.6	37.6±12.6	0.52
3 months	28.7±16.1†	24.0±10.0†	
Δ	-12.7±14.0	-13.5±15.1	0.87

Values are expressed as mean ± standard deviation.

* p value for comparisons of changes in the parameters between the two groups.

† p<0.05 vs baseline within the same group.

Supplementary table 5. Cardiac parameters at baseline and after three months of therapy: per protocol analysis set.

	ASV (n=15)	Oxygen (n=18)	p*
Systolic blood pressure, mmHg			
Baseline	125.3±16.9	120.2±16.4	0.39
3 months	118.9±16.3†	118.4±13.4	
Δ	-6.3±10.3	-1.7±15.5	0.33
Diastolic blood pressure, mmHg			
Baseline	70.1±8.4	69.1±9.6	0.74
3 months	68.5±11.0	67.9±9.2	
Δ	-1.7±9.9	-1.2±13.7	0.91
Heart rate, /m			
Baseline	63.3±11.5	67.4±10.2	0.28
3 months	60.9±11.5	70.7±12.8	
Δ	-2.4±7.7	3.2±11.0	0.11
6MWD, m			
Baseline	478±86	456±76	0.47
3 months	474±118	468±78‡	
Δ	-4±40	12±25	0.21
MLHFQ score			
Baseline	25.9±20.9	24.4±20.1	0.84
3 months	18.7±17.6‡	19.2±16.3‡	
Δ	-7.2±15.0	-5.3±12.4	0.69

Values are expressed as mean ± standard deviation.

ASV, adaptive servo ventilation; 6MWD, 6 minutes walking distance; MLHFQ, Minnesota Living with Heart Failure Questionnaire.

* p value for comparison between ASV and oxygen group.

† $p<0.05$ vs baseline within the same group.

‡ $p<0.10$ vs baseline within the same group.

Supplementary table 6. Changes in body composition measured by bioimpedance analyser: per protocol analysis set

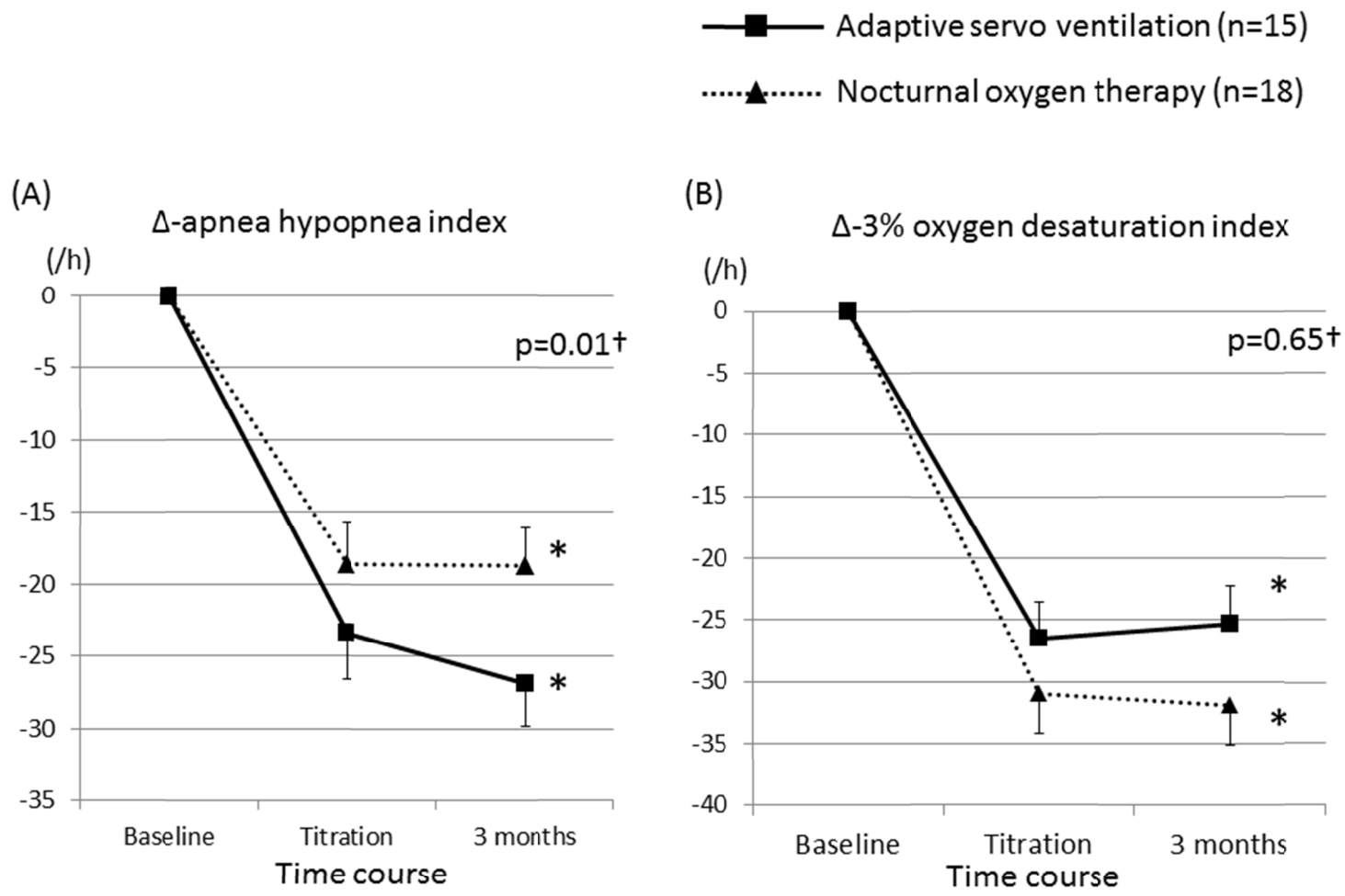
	ASV (n=11)	Oxygen (n=15)	p*
Body mass index, kg/m^2			
Baseline	23.1±3.3	24.8±2.1	0.03
3 months	23.8±3.2†	24.8±2.2	
Δ	0.7±0.8	0.0±0.4	<0.01
Total body water, l			
Baseline	34.1±5.9	34.1±5.0	0.98
3 months	34.6±5.7	34.1±5.1	
Δ	0.5±0.8	0.0±0.7	0.16
Extra cellular water, l			
Baseline	13.1±2.1	13.2±1.9	0.87
3 months	13.3±2.1	13.2±2.0	
Δ	0.2±0.3	0.0±0.3	0.13
Extracellular water/ Total body water , %			
Baseline	38.3±0.4	38.8±0.9	0.15
3 months	38.4±0.4	38.8±0.9	
Δ	0.0±0.0	0.0±0.0	0.64
Fat mass, kg			
Baseline	16.5±6.9	20.3±3.8	0.02
3 months	17.7±6.6†	20.2±4.2	
Δ	1.2±1.7	-0.1±1.0	0.03
Lean fat mass, kg			
Baseline	46.3±8.0	46.2±6.8	0.97
3 months	47.0±7.9	46.2±6.9	
Δ	0.7±1.1	-0.0±0.9	0.10

Values are expressed as mean ± standard deviation.

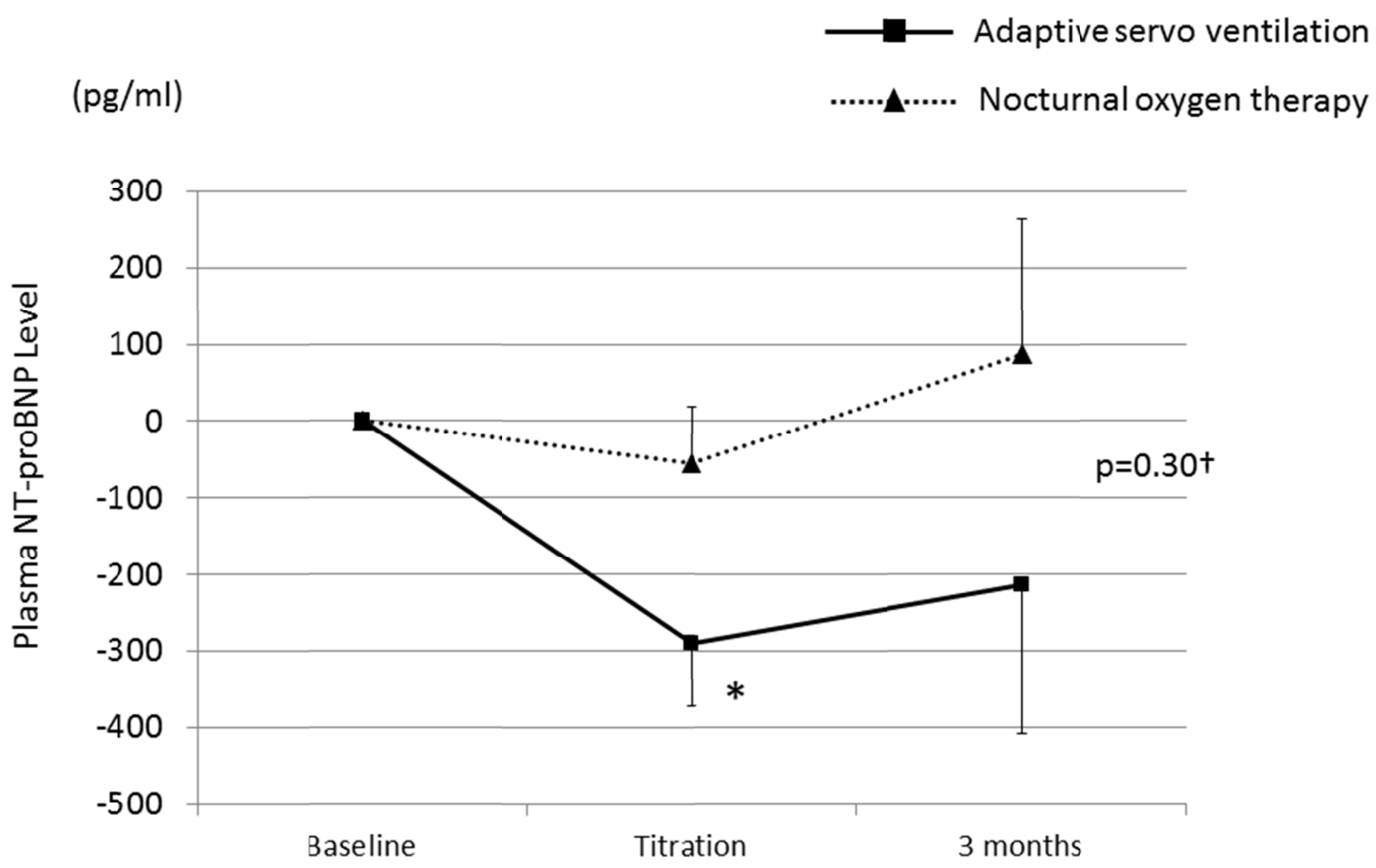
ASV, adaptive servo ventilation.

* p value for comparison between ASV and oxygen group.

† p<0.05 vs baseline within the same group.



Supplementary figure 1



Supplementary figure 2.

Supplementary figure legend

Supplementary figure 1. (A) and (B). Changes in apnea hypopnea index (AHI) and 3% oxygen desaturation index(ODI) from baseline to treatment titration and three months of therapy: per protocol analysis set. Plotted line graphs indicate the mean ± standard error at each assessment.

* One-way repeated measure analyses of variance (ANOVA) showed that both ASV and oxygen therapy significantly decreased AHI (ASV: baseline 34.4±13.3, titration 11.0±11.4, follow-up 7.4±6.6/h, $p<0.01$; oxygen: baseline 38.2±9.5, titration 19.6±11.4, follow-up 19.5±8.3/h, $p<0.01$) and 3%ODI (ASV: baseline 29.5±14.9, titration 3.0±2.5, follow-up 4.2±4.5/h, $p<0.01$; oxygen: baseline 34.2±11.4, titration 3.1±5.4, follow-up 2.3±5.5/h, $p<0.01$) within the same group.

† Two-way measured ANOVA showed that a significant difference was found in the changes in AHI ($p=0.01$) but not in 3% ODI ($p=0.65$) throughout the study between two groups.

Supplementary figure 2. Changes in plasma N-terminal pro-B-type natriuretic peptide (NT-proBNP) level from baseline to treatment titration and three months of therapy: per protocol analysis set. Plotted line graphs indicate the mean ± standard error at each assessment. The changes in NT-proBNP level throughout the study were compared by one-way and two-way repeated measure analyses of variance with post-hoc pairwise comparison within the same group and between two groups, respectively, after NT-proBNP values were log-transformed .

* In the ASV group, the plasma NT-proBNP level significantly decreased from baseline to titration (1570±2487 to 1279±2234 pg/ml, $p<0.01$). At three months, it increased slightly and its change from baseline did not reach statistical significance (1355±1757 pg/ml, $p=0.29$). On the other hand, the oxygen group did not show a significant change throughout the study (baseline 1067±1962, titration 1012±2038, follow-up 1154±2007 pg/ml, $p=0.16$).

† The difference in the change in NT-proBNP throughout the study between the two groups did not

reach statistical significance (p=0.30).