Predictors of Nocturnal Hypoxemic Burden in Patients Undergoing Elective Coronary Bypass Grafting Surgery—Online data supplement

Supplementary tables

Table S1. Baseline variables of the sub-analysis population and patients excluded from the sub-analysis or had insufficient data on nocturnal hypoxemia (drop-out population). Data are presented as absolute and relative frequencies or mean ± standard deviation.

	overall	**sub-analysis population**	**drop-out population**	**p-value**
n (%)	600 (100)	429 (100)	171 (100)	
Age, years	66.6 ± 8.6	66.6 ± 8.5	66.7 ± 9.1	0.827 [T]
Male sex, n (%)	516 (86)	368 (86)	148 (86)	0.806 [Chi]
Body mass index, kg/m²	28.8 ± 4.8	28.6 ± 4.4	29.4 ± 6.0	0.071 [T]
Impaired LV ejection fraction <55%	115 (30)	98 (29)	17 (33)	0.614 [Chi]

NT-pro BNP: N-terminal pro-brain natriuretic peptide. [T] Student's t-test; [Chi] Chi-square test.

Table S2. Baseline variables of the sub-analysis population and patients excluded from the sub-analysis or had insufficient data on nocturnal hypoxemia. Data are presented as absolute and relative frequencies or mean ± standard deviation.

	overall	**sub-analysis population**	**withdrawal population**	**patients with insufficient data on nocturnal hypoxemia**	**p-value**
n (%)	600 (100)	429 (100)	101 (100)	70 (100)	
Age, years	66.6 ± 8.6	66.6 ± 8.5	66.6 ± 9.7	66.9 ± 8.2	0.951 [A]
Male sex, n (%)	516 (86)	368 (86)	89 (88)	59 (84)	0.754 [Chi]
Body mass index, kg/m²	28.8 ± 4.8	28.6 ± 4.4	30.1 ± 7.0	28.7 ± 4.9	0.052 [A]
Impaired LV ejection fraction <55%	115 (30)	98 (29)	7 (35)	10 (31)	0.845 [Chi]

NT-pro BNP: N-terminal pro-brain natriuretic peptide. Chi-square test; [A] ANOVA test.

Table S3. Patient characteristics. Data are presented as mean ± standard deviation, median (interquartile range) or absolute and relative frequencies.

	no heart failure, no mild to moderate COPD, no obesity, no SDB	**heart failure**	**mild to moderate COPD**	**obesity**	**SDB**	**2/4 comorbidities**	**≥3/4 comorbidities**	**p-value**
Demographics								
n (%)	134 (31)	19 (4)	14 (3)	50 (12)	63 (15)	109 (25)	40 (9)	
Age, years	66.3 ± 8.7	63.9 ± 11.7	63.2 ± 9.5	65.4 ± 8.2	69.0 ± 8.2	66.9 ± 7.6	66.6 ± 7.8	**0.025** [A]
Male sex, n (%)	112 (84)	17 (89)	13 (93)	41 (82)	56 (89)	93 (85)	36 (90)	0.808 [Chi]
Body mass index, kg/m²	26.0 ± 2.5	24.9 ± 3.0	26.7 ± 2.0	32.8 ± 2.7	26.3 ± 2.6	30.9 ± 4.5	32.0 ± 3.8	0.429 [A]
Cardiovascular risk factors								
Hypertension, n (%)	105 (78)	14 (74)	11 (79)	46 (92) [#]	45 (71)	97 (89) [#]	38 (95) [#]	**0.004** [Chi]
Hypercholesterinaemia, n (%)	78 (58)	9 (47)	7 (50)	34 (68)	45 (71)	72 (66)	21 (52)	0.183 [Chi]
Diabetes mellitus, n (%)	29 (22)	7 (37)	3 (21)	23 (46) [#]	19 (30)	41 (38) [#]	20 (50) [#]	**0.004** [Chi]
Obesity, n (%)	0 (0)	0 (0)	0 (0)	50 (100) [#]	0 (0)	73 (67) [#]	34 (85) [#]	**<0.001** [Chi]
Smoking, n (%)	84 (63)	16 (84)	8 (57)	32 (64)	42 (67)	74 (68)	32 (80)	0.269 [Chi]
Comorbidities								
Heart failure[*], n (%)	0 (0)	19 (100) [#]	0 (0)	0 (0)	0 (0)	38 (35) [#]	30 (75) [#]	**<0.001** [Chi]
NYHA III/IV, n (%)	15 (11)	3 (16)	2 (14)	13 (26) [#]	6 (9)	37 (34) [#]	20 (50) [#]	**<0.001** [Chi]
History of myocardial infarction, n (%)	29 (22)	8 (42)	4 (29)	14 (28)	22 (33)	33 (30)	13 (32)	0.479 [Chi]
Atrial fibrillation, n (%)	15 (11)	5 (26)	0 (0)	3 (6)	5 (8)	26 (24) [#]	6 (15)	**0.004** [Chi]
History of TIA or stroke, n (%)	14 (10)	1 (5)	1 (7)	9 (18)	12 (19)	17 (16)	4 (10)	0.422 [Chi]
Mild to moderate chronic obstructive pulmonary disease, n (%)	0 (0)	0 (0)	14 (100) [#]	0 (0)	0 (0)	12 (11) [#]	18 (45) [#]	**<0.001** [Chi]
Renal failure[†], n (%)	18 (14)	4 (21)	4 (29)	12 (24)	7 (11)	34 (31) [#]	9 (22)	**0.015** [Chi]
Anemia[‡], n (%)	25 (19)	5 (26)	3 (21)	9 (18)	12 (19)	22 (20)	11 (27)	0.912 [Chi]
Depression, n (%)	8 (6)	0 (0)	0 (0)	2 (4)	3 (5)	2 (2)	4 (10)	0.322 [Chi]
Echocardiography parameters								

LV ejection fraction, %	59.5 ± 8.1	45.4 ± 9.9 #	59.2 ± 7.9	61.5 ± 7.6	55.0 ± 12.7	52.1 ± 12.4 #	45.5 ± 14.3 #	**<0.001** A
Impaired LV ejection fraction <55%, n (%)	7 (11)	0 (0)	0 (0)	2 (10)	3 (11)	10 (17)	9 (32)	0.056 Chi
Left atrial enlargement, n (%)	35 (35)	5 (56)	3 (27)	20 (49)	18 (37)	49 (59) #	24 (83) #	**<0.001** Chi
Laboratory data								
NT-proBNP, pg/ml	159 (70; 472)	1961 (938; 3153) #	153 (88; 257)	153 (79; 409)	254 (94; 477)	453 (128; 1619) #	1924 (996; 2782) #	**<0.001** KW
Hemoglobin, g/dl	14.2 (13.3; 15.0)	14.3 (11.2; 15.2)	13.8 (12.0; 15.3)	14.5 (13.0; 15.3)	14.2 (13.4; 14.8)	13.9 (12.9; 14.6)	14.2 (12.7; 15.9)	0.805 KW
Hb1Ac, g/dl	5.7 (5.5; 6.2)	5.8 (5.3; 6.3)	5.8 (5.4; 7.4)	6.1 (5.6; 6.6)	5.8 (5.5; 6.4)	5.9 (5.5; 6.7)	6.1 (5.7; 6.9)	0.088 KW
Creatinine, mg/dl	0.95 (0.81; 1.05)	0.89 (0.81; 1.12)	0.97 (0.85; 1.24)	0.94 (0.82; 1.09)	0.94 (0.84; 1.07)	1.00 (0.85; 1.22)	1.00 (0.88; 1.18)	0.198 KW
GFR, ml/min/1,73 m²	81 (71; 91)	89 (55; 91)	91 (53; 94)	82 (65; 92)	81 (68; 89)	76 (55; 89)	74 (61; 90)	0.132 KW
Preoperative information on surgical treatment								
CABG and valve surgery, n (%)	29 (22)	8 (42)	1 (7)	14 (28)	4 (6) #	27 (25)	12 (30)	**0.006** Chi
Number of coronary stenoses, n	3 (3; 4)	4 (3; 6)	4 (3; 5)	4 (3; 5)	4 (3; 5)	3 (3; 5)	3 (3; 5)	0.173 KW
Number of grafts, n	2 (2; 3)	2 (2; 3)	2 (2; 3)	3 (1; 3)	3 (2; 3)	2 (2; 3)	3 (2; 3)	0.514 KW

A ANOVA test; Chi Chi-square test; KW Kruskal-Wallis-test. NYHA: New York Heart Association; TIA: transient ischemic attack; LV: left ventricular; NT-proBNP: N-terminal pro-brain natriuretic peptide; HbA1c: glycosylated Hemoglobin, Type A1C; GFR: glomerular filtration rate; CABG: coronary artery bypass grafting. * n=363; NT-proBNP ≥450 pg/mL (patients <50 years of age), ≥900 pg/mL (patients ≥50 and <75 years of age) or ≥1800 pg/mL (patients ≥75 years of age); † glomerular filtration rate <60 ml/min/1.73 m²; ‡ hemoglobin <12 g/dl (women) or hemoglobin <13 g/dl (men); # post hoc analysis <0.05, compared to patient group with no heart failure, no mild to moderate COPD, no obesity, no SDB.

Table S4. Nocturnal respiration data of the study population of patients (n = 429) without and with an elevated nocturnal hypoxemic burden index. Data are presented as median (interquartile range) or absolute and relative frequencies.

	no heart failure, no mild to moderate COPD, no obesity, no SDB	**heart failure**	**mild to moderate COPD**	**obesity**	**SDB**	**2/4 comorbidities**	**≥3/4 comorbidities**	**p-value**
Total recording time, min	487 (471; 501)	484 (453; 494)	477 (465; 486)	484 (466; 501)	491 (465; 507)	485 (463; 507)	488 (471; 504)	0.508 [KW]
Apnea hypopnea index, per hour	6.5 (3.7; 10.7)	7.9 (4.6; 11.3)	5.4 (3.4; 11.2)	9.7 (6.5; 11.6)	22.0 (17.9; 34.7)	23.9 (19.0; 33.4)	28.7 (21.3; 43.7)	**<0.001** [KW]
Obstructive apnea index, per hour	1.2 (0.4; 2.2)	0.8 (0.1; 1.8)	1.0 (0.5; 1.8)	1.1 (0.5; 2.1)	4.9 (2.4; 11.5)	4.0 (1.5; 9.2)	4.9 (1.8; 12.0)	**<0.001** [KW]
Central apnea index, per hour	0.9 (0.3; 2.2)	1.4 (0.1; 2.5)	1.6 (0.4; 3.4)	0.8 (0.2; 2.8)	6.2 (2.4; 13.7)	5.7 (1.8; 13.1)	4.9 (0.4; 23.3)	**<0.001** [KW]
Oxygen desaturation index, per hour	4.8 (1.9; 8.4)	7.4 (3.1; 11.2)	4.5 (2.1; 10.5)	7.4 (5.4; 9.4)	17.8 (14.5; 29.8)	21.3 (15.1; 30.8)	25.6 (17.0; 42.1)	**<0.001** [KW]
Mean SpO_2, %	93 (92; 94)	93 (92; 94)	90 (92; 93)	92 (91; 93)	93 (91; 94)	92 (90; 93)	91 (89; 92)	**<0.001** [KW]
Min SpO_2, %	85 (82; 88)	85 (83; 88)	83 (81; 86)	82 (79; 85)	82 (78; 84)	80 (75; 84)	76 (73; 83)	**<0.001** [KW]
T90/TRT, %	1.6 (0.2; 11.3)	2.4 (0.2; 10.6)	5.0 (2.3; 35.9)	7.6 (2.4; 20.1)	9.9 (2.4; 23.9)	12.6 (5.5; 31.2)	34.8 (10.8; 65.5)	**<0.001** [KW]
$T90_{desaturation}$/TRT, %	0.6 (0.1; 2.6)	0.6 (0.1; 3.6)	1.4 (0.6; 6.2)	1.6 (0.7; 4.8)	6.3 (1.5; 11.9)	7.6 (3.2; 14.4)	13.6 (7.7; 28.4)	**<0.001** [KW]
$T90_{non\text{-}specific}$/TRT, %	0.4 (0.0; 7.5)	0.9 (0.0; 6.6)	4.1 (0.9; 30.7)	6.8 (0.7; 18.9)	1.4 (0.1; 10.0)	3.7 (0.3; 14.8)	16.7 (1.4; 39.4)	**<0.001** [KW]
Sleep-disordered breathing (Apnea-hypopnea index ≥15/hour), n (%)	0 (0)	0 (0)	0 (0)	0 (0)	63 (100)	95 (87)	40 (100)	**<0.001** [Chi]
Obstructive sleep apnea (Apnea-hypopnea index ≥15/hour), n (%)	0 (0)	0 (0)	0 (0)	0 (0)	27 (43)	37 (34)	18 (45)	
Central sleep apnea (Apnea-hypopnea index ≥15/hour), n (%)	0 (0)	0 (0)	0 (0)	0 (0)	36 (57)	58 (53)	22 (55)	

[Chi] Chi-square test; [KW] Kruskal-Wallis-test. TRT: artefact-free total recording time.

Supplementary figure

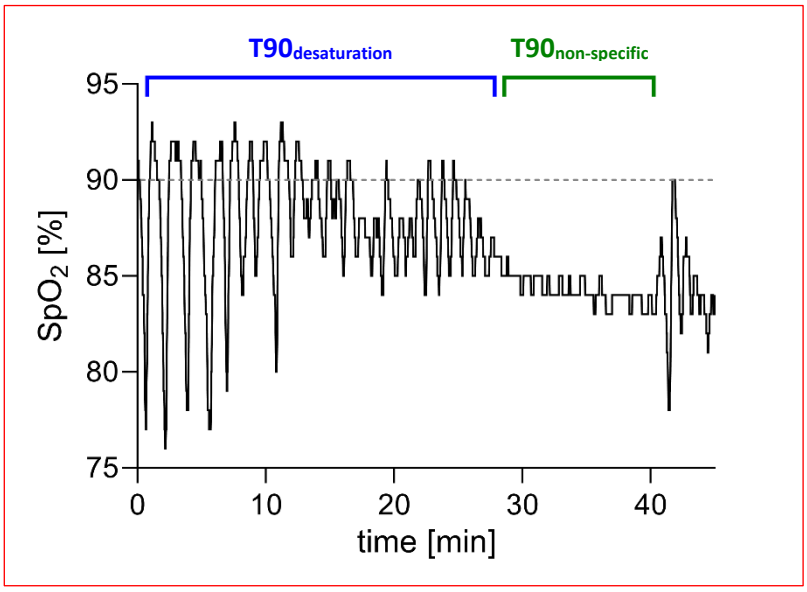

Figure S1. Descriptive diagram of T90 with acute oxygen desaturation events accompanied by resaturation ($T90_{desaturation}$) and T90 associated with non-specific drifts in SpO2 or incomplete resaturation ($T90_{non\text{-}specific}$) as obtained from raw oximetry data with the use of a custom MATLAB software algorithm.

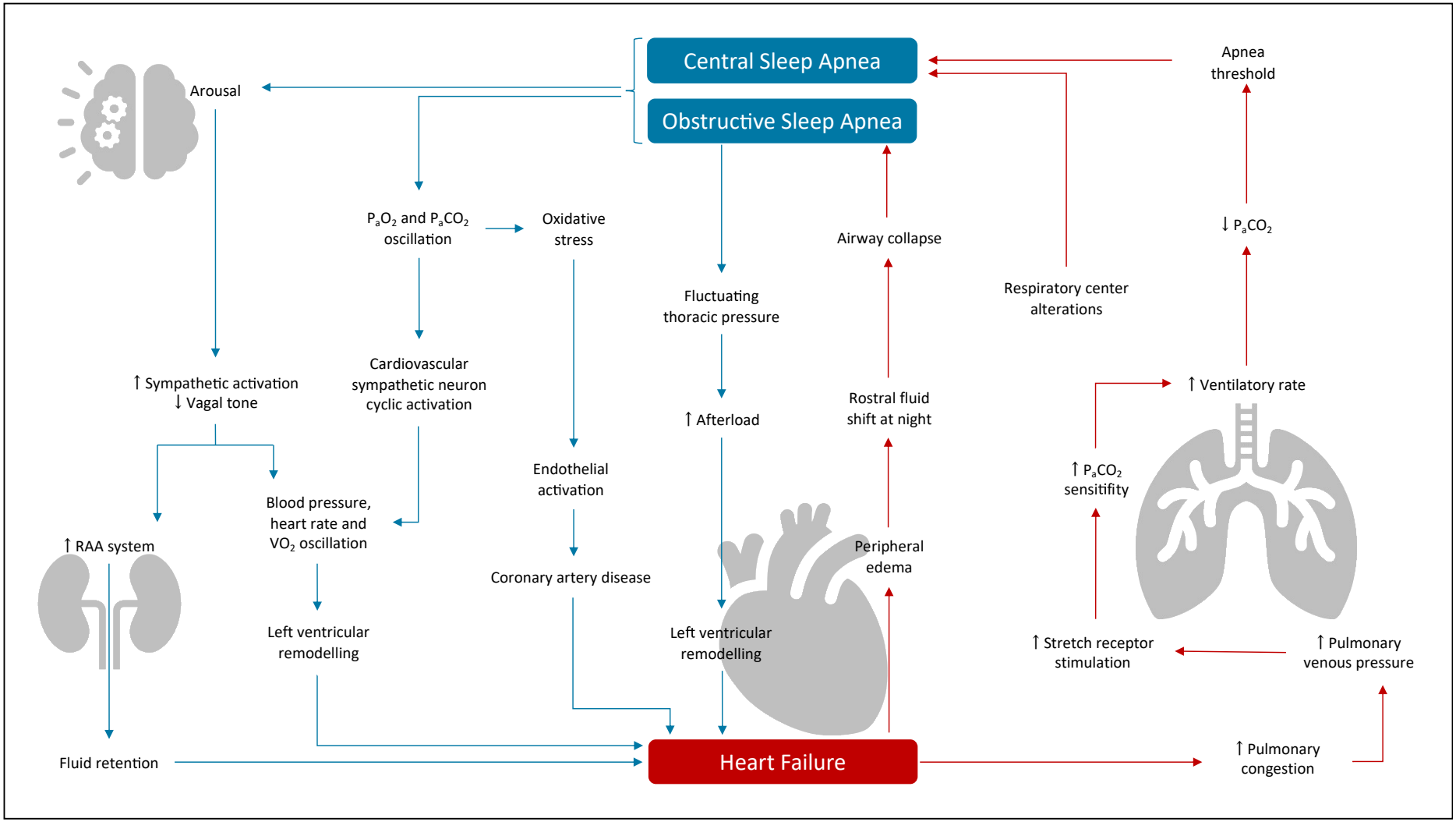

Figure S2. Schematic model depicting the relationship between sleep apnea and heart failure (illustration modified from Parati G et al. 2016)[2]. RAA: Renin-angiotensin-aldosterone; VO_2: oxygen consumption.