

Sleep disordered breathing in morbidly obese patients prior to bariatric surgery - a retrospective analysis of a single centre cohort

Christian M. Horvath^{1,3}, Juri Jossen¹, Anne-Kathrin Brill¹, Philipp Nett², Florent Baty³, Sebastian R. Ott¹
¹ Department of Pulmonary Medicine, University Hospital and University of Bern, Bern, Switzerland
² Department of Gastroenterology, University Hospital and University of Bern, Bern, Switzerland
³ Department of Pulmonary and Sleep Medicine, Kantonsspital St. Gallen, Switzerland

Background

Obstructive sleep apnea (OSA) is a common disease in the general population. Obesity is a strong risk factor of OSA and its prevalence is continuously increasing with an estimated number of 1.1 billion obese individuals (BMI>30 kg/m²) by 2030. Bariatric surgery is an intervention that produces substantial and sustained weight loss in adults. Due to the increased peri- and postoperative risk in these patients an assessment for sleep apnoea prior to bariatric surgery is recommended.

Study objective

The aim of this retrospective cohort study was to investigate prevalence and independent predictive factors of OSA (AHI>5/h) in obese patients prior to bariatric surgery in a single university centre.

Material and Methods

We analysed data of all morbidly obese patients (BMI>35 kg/m²) who underwent a home respiratory polygraphy prior to bariatric surgery between January 2012 to July 2015. Additional demographic data, laboratory values, pulmonary function testing and data from sleep questionnaires (STOPBang, Epworth Sleepiness Scale, Fatigue Severity Scale) were analysed.

Statistics

All data are reported descriptively using median together with interquartile range. Sensitivity, specificity, negative and positive predictive values were inferred using confusion matrix analyses.

Results

Variables	AHI				Univariate p-value			Multivariate p-value		
	0-4.9	5-14.9	15-29.9	≥30	5-14.9	15-29.9	≥30	≥5/h	≥15/h	≥30h
Age	36 (26-44)	43 (33-53)	46 (38-54)	46 (41-58)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p<0.005
BMI	41.26 (37.76-44.99)	42.71 (39.08-45.39)	46.19 (39.56-51.65)	45.11 (41.50-49.70)	p=0.05	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
Neck circumference (cm)	40.0 (37.3-42.0)	41.0 (40.2-45.0)	45.0 (41.5-47.5)	46.2 (43.8-48.0)	p<0.005	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
FEV1 (l)	3.07 (2.74-3.51)	2.98 (2.64-3.37)	2.83 (2.36-3.44)	3.00 (2.48-3.74)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
FVC(l)	3.83 (3.44-4.48)	3.76 (3.30-4.13)	3.58 (3.11-4.30)	4.02 (3.31-4.80)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
STOPBANG	3 (2-3)	3 (3-4)	4 (3-5)	5 (4-6)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
ESS	6 (4-9)	6 (4-10)	7 (4-9)	11 (7-14)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
FSS	3.11 (2.22-4.39)	4.00 (2.56-5.00)	3.33 (2.33-4.11)	4.89 (2.83-5.45)	p=0.05	p=0.05	p<0.005	p=0.05	p=0.05	p=0.05
VAS (1-10)	5 (2-6)	5 (2-6)	4 (0-5)	4 (0-5)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
ODI (4%)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
SPO2 mean (%)	93.8 (93.0-94.9)	92.85 (91.80-94.00)	92.4 (90.3-93.5)	86.9 (89.3-91.1)	p<0.005	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
SPO2<90% (min)	2.15 (0.30-16.55)	1.75 (0.51-42.2)	33.4 (18.2-165.2)	185.8 (89.8-260.5)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
AHI supine position	1.4 (0.3-3.3)	9.5 (5.2-15.1)	22.5 (14.2-37.5)	53.2 (24.4-66.9)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
PH	7.43 (7.42-7.45)	7.44 (7.42-7.45)	7.43 (7.42-7.45)	7.45 (7.42-7.45)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
PACO2 (mm Hg)	35 (32-37)	36.5 (34.5-38.0)	37 (34-39)	36 (34-39)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
HCO3- (mm Hg)	24.0 (23.0-24.8)	24.0 (23.0-25.4)	25.1 (24.2-25.9)	25.0 (23.1-26.4)	p<0.001	p<0.005	p<0.005	p=0.05	p=0.05	p=0.05
PAO2 (mm Hg)	85.0 (79.1-92.0)	79.5 (71.5-86.5)	76.0 (70.0-86.0)	69.0 (63.0-75.5)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
Cholesterin	4.85 (4.16-5.60)	4.95 (4.32-5.63)	5.15 (4.50-5.71)	5.10 (4.27-5.64)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
HDL	1.27 (1.08-1.50)	1.20 (0.96-1.39)	1.22 (1.14-1.46)	1.13 (1.01-1.25)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
LDL	2.90 (2.34-3.59)	3.04 (2.49-3.68)	3.11 (2.50-3.65)	2.91 (2.49-3.52)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Triglyceride	1.24 (0.93-1.65)	1.45 (1.02-2.01)	1.47 (1.08-1.81)	1.70 (1.26-2.28)	p=0.05	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
TSH	2.03 (1.44-2.97)	1.86 (1.34-2.69)	1.97 (1.63-2.85)	2.31 (1.93-3.12)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cortisol	284 (208-408)	298 (230-396)	374 (292-478)	345 (272-436)	p<0.005	p<0.005	p<0.005	p=0.05	p=0.05	p=0.05
Oestradiol	162 (95-340)	108 (69-190)	104 (52-119)	108 (79-187)	p<0.005	p<0.005	p<0.005	p=0.05	p=0.05	p=0.05
LH	5.6 (3.5-8.2)	7.1 (4.2-19.1)	6.6 (4.8-11.9)	5.2 (3.7-7.3)	p<0.005	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
FSH	5.10 (3.55-7.45)	7.10 (3.80-19.00)	7.80 (4.00-19.80)	5.80 (5.00-9.00)	p<0.001	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
HbA1c	5.55 (5.30-5.80)	5.80 (5.55-6.50)	5.90 (5.55-6.60)	6.30 (5.90-7.95)	p<0.01	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
Arterial hypertension (n)	45	28	19	17	p=0.05	p=0.05	p<0.005	p=0.05	p=0.05	p=0.05
Coronary artery disease (n)	0	2	0	0	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cardiac arrhythmia (n)	1	0	2	1	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Diabetes mellitus (n)	14	15	11	11	p<0.005	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
COPD/Asthma (n)	14	3	5	6	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cerebrovascular disease (n)	6	1	1	4	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Gastroesophageal reflux disease (n)	46	30	9	7	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Dyslipidemia (n)	30	27	13	8	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
Psychiatric disease (n)	55	18	8	9	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Smoker (n)	28	17	5	3	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Former smoker (n)	12	6	2	4	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05

Table 1: Patient demographics, AHI and factors predictive for OSA

Results

Variables	AHI				Univariate p-value			Multivariate p-value		
	0-4.9	5-14.9	15-29.9	≥30	5-14.9	15-29.9	≥30	≥5/h	≥15/h	≥30h
Age	36 (26-44)	42 (31-54)	50 (38-55)	47 (43-49)	p<0.005	p<0.001	p<0.005	p=0.05	p=0.05	p=0.05
BMI	41.26 (38.03-44.90)	42.64 (39.15-45.10)	45.91 (39.56-48.61)	48.62 (42.10-54.36)	p=0.05	p=0.05	p<0.001	p=0.05	p=0.05	p=0.05
Neck circumference (cm)	39 (37-41)	40 (39-41)	43 (41-44.5)	43.5 (43-44.0)	p=0.05	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
FEV1 (l)	3.01 (2.64-3.38)	2.78 (2.49-3.10)	2.46 (2.25-2.86)	2.74 (2.27-2.89)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
FVC(l)	3.74 (3.36-4.25)	3.53 (3.10-3.94)	3.19 (2.58-3.58)	3.28 (3.05-3.67)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
STOPBANG	2 (2-3)	3 (2-4)	4 (2-5)	5 (4-5)	p<0.005	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
ESS	6 (4-9)	6 (4-10)	7 (6-12)	12 (8-15)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
FSS	3.11 (2.22-4.39)	4 (1.95-4.56)	3.33 (2.33-4.33)	5.06 (1.78-6.11)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
VAS (1-10)	5 (2-6)	5 (2-6)	4 (1.3-5)	5 (5-6)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
ODI (4%)	2 (1-4)	10 (7-14)	23 (18-28)	58 (36-83)	p<0.005	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
SPO2 mean (%)	93.8 (93.0-94.9)	92.9 (91.8-94.0)	92.4 (90.3-93.5)	89.3 (86.9-91.1)	p<0.001	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
SPO2<90% (min)	2 (1-17)	16 (5-42)	33 (18-165)	186 (90-260)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
AHI supine position	1.4 (0.3-3.4)	9.6 (5.3-15.4)	26.9 (16.9-29.8)	42.8 (29.2-72.1)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
PH	7.44 (7.42-7.46)	7.44 (7.43-7.45)	7.44 (7.42-7.45)	7.46 (7.45-7.46)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
PACO2 (mm Hg)	34 (32-36)	36 (34-38)	36 (34-38)	35 (34-36)	p=0.05	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
HCO3- (mm Hg)	23.80 (22.90-24.65)	24.70 (23.80-26.60)	25.10 (24.1-25.90)	25.10 (22.50-26.20)	p<0.001	p<0.01	p<0.001	p=0.05	p=0.05	p=0.05
PAO2 (mm Hg)	86 (81-92)	80 (74-88)	80 (75-87)	70 (64-72)	p<0.001	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
Cholesterin	4.84 (4.11-5.61)	4.95 (4.37-5.59)	4.96 (4.50-5.78)	5.10 (4.32-5.47)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
HDL	1.30 (1.11-1.56)	1.20 (0.98-1.37)	1.26 (1.22-1.49)	1.22 (1.05-1.49)	p<0.001	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
LDL	2.87 (2.32-3.54)	3.05 (2.62-3.56)	3.07 (2.46-3.48)	2.98 (2.78-3.57)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Triglyceride	1.22 (0.96-1.54)	1.44 (1.01-1.84)	1.46 (1.07-1.72)	1.42 (1.15-1.70)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
TSH	2.02 (1.45-2.98)	1.86 (1.33-2.71)	2.16 (1.65-2.99)	2.86 (1.93-3.59)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cortisol	286 (212-423)	284 (223-399)	400 (257-628)	321 (218-422)	p=0.05	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
Oestradiol	199 (107-357)	92 (66-183)	400 (44-149)	124 (80-211)	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
LH	5.70 (3.15-9.55)	11.7 (4.7-20.6)	8.9 (4.8-21.3)	5.05 (3.70-9.90)	p<0.001	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
FSH	5.3 (3.7-7.5)	8.0 (5.4-36.6)	9.55 (4.05-38.7)	9.0 (4.6-11.7)	p<0.001	p<0.005	p<0.001	p=0.05	p=0.05	p=0.05
HbA1c	5.5 (5.3-5.8)	5.70 (5.50-6.15)	6.00 (5.65-7.05)	6.25 (6.00-6.80)	p<0.001	p<0.001	p<0.001	p=0.05	p=0.05	p=0.05
Arterial hypertension (n)	33	21	5	7	p<0.001	p=0.05	p<0.001	p=0.05	p=0.05	p=0.05
Coronary artery disease (n)	0	1	0	0	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cardiac arrhythmia (n)	1	0	0	0	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Diabetes mellitus (n)	11	3	4	1	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
COPD/Asthma (n)	11	3	4	1	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Cerebrovascular disease (n)	5	1	1	0	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05	p=0.05
Gastroesophageal reflux disease (n)	36	7	4	3	p=0.05</					