Utility of the STOP-BANG Questionnaire for Identifying Obstructive Sleep Apnea in Patients Undergoing Bariatric Surgery

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INTRODUCTION

Patients undergoing bariatric surgery are at high risk for obstructive sleep apnea (OSA).

OSA has been associated with an increased risk of perioperative complications, but is under-recognized and underdiagnosed in the bariatric population.

It is currently recommended that ***all*** patients considering bariatric surgery for obesity should be evaluated for OSA.

In the general pre-surgical population, the STOP-BANG questionnaire is a validated screening tool for identifying OSA.

We hypothesize that in bariatric patients the STOP-BANG questionnaire plus other clinical variables can predict OSA.

METHODS

The study population included 185 patients who had bariatric surgery at Thomas Jefferson University Hospital from August 2012 to October 2013 and underwent a pre-operative screening polysomnogram (PSG).

We recorded demographic, anthropometric, and clinical data, including: STOP-BANG Score, bicarbonate level, Mallampati score, Epworth Sleepiness score, PSG data, tobacco use and medical comorbidities [Tables 1-3].

Statistical analyses were performed to evaluate the association between the STOP-BANG score as well as other clinical variables and OSA (defined as apnea-hypopnea index (AHI ≥ 5).

Predictive performance of different values of STOP-BANG scores and clinical variables were also analyzed.

RESULTS

Table 1. Summary of STOP-BANG Score

S	Snoring, n (%)	157	84.9%
T	Tired, n (%)	107	57.8%
O	Observed apneas, n (%)	44	23.8%
P	high blood Pressure, n (%)	103	55.7%
B	BMI ≥ 35, n (%)	184	99.5%
	BMI (kg/m^2), mean ± SD	46.4 ±	6.6
	BMI < 35, n (%)	1	0.5%
	BMI 35 - 39.9, n (%)	30	16.2%
	BMI 40 - 44.9, n (%)	57	30.8%
	BMI 45 - 49.9, n (%)	42	22.7%
	BMI ≥ 50, n (%)	55	29.7%
A	Age ≥ 50, n (%)	53	28.7%
	Age (years), mean ± SD	41.9 ±	11.2
N	Neck circumference ≥ 17 inch (M) or ≥ 16 inch (F), n (%)	90	48.7%
	Neck Circumference (inch), mean ± SD	15.8 ±	1.8
G	male Gender, n (%)	27	14.6%
	Total Score, mean ± SD	4.1 ±	1.4
	Score = 1	2	1.1%
	Score = 2	20	10.8%
	Score = 3	46	24.9%
	Score = 4	40	21.6%
	Score = 5	46	24.9%
	Score = 6	22	11.9%
	Score = 7	9	4.9%

Table 2. Summary of PSG Findings and Clinical Variables

AHI, mean ± SD	16.6 ±	28.4
AHI, n (%)		
< 5 (no OSA)	82	44.3%
5-14.9 (mild OSA)	56	30.3%
15-29.9 (moderate OSA)	19	10.3%
≥30 (severe OSA)	28	15.1%
Total ≥5 (all OSA)	103	55.7%
Total ≥15 (moderate-severe OSA)	47	25.4%
RDI, mean ± SD	22.6 ±	30.7
Nadir SaO2 (%), mean ± SD	84.6 ±	8.3%
Bicarbonate ≥ 28. n (5)	53	28.7%
Mallampati Score, mean ± SD	3.6 ±	0.7
Epworth Sleepiness Score, mean ± SD	7.1 ±	4.5

Table 3. Summary of Medical Comorbidities

Coronary Artery Disease, n (%)	7	3.8%
Diabetes Mellitus, n (%)	45	24.3%
Asthma, n (%)	28	15.1%
Depression, n (%)	34	18.4%
Anxiety, n (%)	28	15.1%
GERD, n (%)	36	19.5%
Hypothyroidism, n (%)	24	13.0%
Hyperlipidemia, n (%)	44	23.8%
Hypertension, n (%)	103	55.7%
Tobacco Use, n (%)	43	23.2%

- Body mass index (BMI) was < 40 in 16.7%, between 40 – 49.9 in 53.5% and ≥ 50 in 29.7%. The mean BMI was 46.4 [Table 1].
- OSA was present in 55.7% of patients; with 30.3% mild, 10.3% moderate, and 15.1% severe. The mean AHI was 16.6 [Table 2].
- STOP-BANG scores of ≥ 3 (p=0.03, N=163) were predictive of OSA [Table 4].
- Hypertension (p=0.01) and tobacco use (p=0.03)were associated with OSA.
- Coronary artery disease, diabetes mellitus, asthma, depression, anxiety, acid reflux, hypothyroidism, hyperlipidemia, bicarbonate, Epworth score and Mallampati score did not predict OSA.
- Adding tobacco use to the STOP-BANG questionnaire increased sensitivity to 93.1%, yet decreased specificity to 17.1%.
- There was a positive correlation between BMI and AHI ($p < 0.0001$) [Figure 1, Figure 2].
- Increasing the STOP-BANG BMI cutoff to ≥ 40 yielded a sensitivity of 92.2% and increased specificity to 26.8% [Table 6].

Figure 1. Association between BMI and AHI:

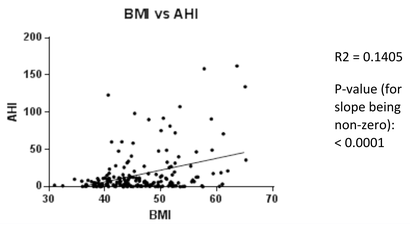

Table 4. Prediction of OSA by STOP-BANG Score

STOPBANG Score Cutoff	P-value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
≥3	0.0331	92.1 (85.1-96.5)	18.3 (10.6-28.4)	58.4 (50.4-66.1)	65.2 (42.7-83.6)
≥4	0.0006	74.5 (64.9-82.6)	50.0 (38.8-61.3)	65.0 (55.6-73.6)	61.2 (48.5-72.9)
≥5	<0.0001	59.8 (49.6-69.4)	79.3 (68.9-87.4)	78.2 (67.4-86.8)	61.3 (51.4-70.6)
≥6	<0.0001	26.5 (18.2-36.1)	96.3 (89.7-99.2)	90.0 (73.5-97.9)	51.3 (43.1-59.4)

Figure 2. Presence and Severity of OSA vs . BMI

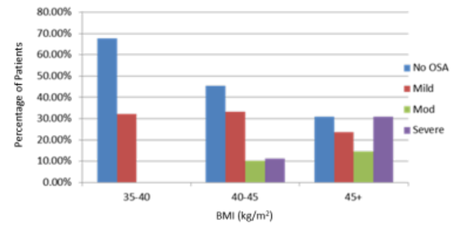

Figure 3. Presence of Sleep Apnea vs. BMI and STOP-BANG Score

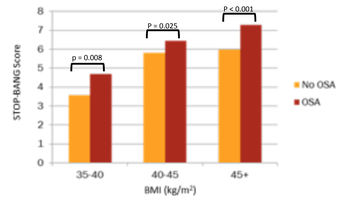

Table 5. Prediction of OSA with the STOP-BANG Score using Different BMI Cutoffs

BMI Cutoff	P-value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
≥40	0.0022	90.3 (82.9-95.3)	26.8 (17.6-37.8)	60.8 (52.6-68.6)	68.8 (50.0-83.9)
≥45	0.1388	57.3 (47.2-67.0)	53.7 (42.3-64.8)	60.8 (50.4-70.6)	50.0 (39.2-60.9)
≥50	0.0169	36.9 (27.6-47.0)	79.3 (68.9-87.4)	69.1 (55.2-80.9)	50.0 (41.1-58.9)
≥55	0.0133	16.5 (9.9-25.1)	95.1 (88.0-98.7)	81.0 (58.1-94.6)	47.6 (39.7-55.5)

Table 6. Prediction of OSA by Modified STOP-BANG Score using BMI ≥ 40

STOPBANG Score Cutoff	P-value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
≥3	0.0005	92.2 (85.1-96.6)	26.8 (17.6-37.8)	61.0 (52.9-68.8)	73.3 (54.1-87.7)
≥4	0.0001	69.6 (59.7-78.3)	58.5 (47.1-69.3)	67.6 (57.8-76.4)	60.8 (49.1-71.6)
≥5	<0.0001	56.9 (46.7-66.6)	82.9 (73.0-90.3)	80.6 (69.5-88.9)	60.7 (51.0-69.8)
≥6	<0.0001	25.5 (17.4-35.1)	97.6 (91.5-99.7)	92.9 (76.5-99.1)	51.3 (43.2-59.4)

CONCLUSIONS

The STOP-BANG questionnaire is a sensitive screening tool for identifying OSA in the bariatric population, yet suffers from low specificity.

Hypertension, tobacco use, and BMI are associated with OSA.

Changing the STOP-BANG BMI cutoff to ≥ 40 preserve sensitivity and enhances specificity.

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