Obstructive Sleep Apnea: Is It a Biomarker of Metabolically Healthy Vs. Abnormal Obesity

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Background

- The prevalence of obstructive sleep apnea (OSA) increases with obesity, and OSA has been linked to increased cardiovascular (CV) risk and numerous cardio-metabolic abnormalities including insulin resistance, hypertension, dyslipidemia, and fatty liver disease.
- Proposed mechanisms by which OSA negatively impacts the CV system include hypoxemia and sleep disruption, leading to sympathetic nervous system activation, systemic inflammation, and increased oxidative stress, all factors implicated in the mediation of obesity-related complications.
- We hypothesized that if OSA contributes to CV risk, then obese individuals with OSA will have more cardio-metabolic abnormalities compared to those without OSA. We further hypothesized that subjects with OSA who are non-compliant with continuous positive airway pressure (CPAP) would have a greater incidence of cardio-metabolic abnormalities including insulin resistance and impaired beta-(β)-cell function than CPAP compliant patients.

Methods

- We prospectively recruited obese patients scheduled to undergo bariatric surgery at The Ohio State University Wexner Medical Center for Minimally invasive surgery.
- All patients had formal testing for OSA with polysomnography. Subjects were further stratified by 1 the absence (negative polysomnography) or presence (positive polysomnography or use of CPAP) of OSA, and 2 the absence or presence of cardio-metabolic abnormalities: hypertension, type 2 diabetes mellitus/pre diabetes, dyslipidemia and/or fatty liver disease.
- Laboratory analysis for glucose, insulin, and adiponectin levels was performed and homeostasis model assessment for estimated insulin resistance and beta-cell function (HOMA-IR and HOMA-B) were calculated.
- Individual CPAP reports for compliance and apnea-hypopnea index (AHI) were available and reviewed for a subset of 38 subjects with OSA and additional analysis was performed.

Results

- 83 patients (BMI 48.64 ± 8.75 kg/m2) were included in the overall analyses: 57 (68.7%) patients had OSA and 26 (31.3%) patients did not have OSA (Figure 1).
- While 78.9% of patients with OSA and 53.3% without OSA had ≥2 cardio-metabolic abnormalities (≥2; 5.47, p<0.02), when adjusted for age and BMI by multivariate linear regression this difference was nonsignificant (p=0.36).
- In a subset of patients on CPAP compliance was assessed. No differences in the prevalence of prediabetes/diabetes (≥2; p=0.259), hypertension (≥2; p=0.103), dyslipidemia (≥2; p=0.444), or fatty liver disease (≥2; p=0.334) in those with documented good CPAP compliance (use > 4 hours per night on 70% of nights) vs. non-compliant CPAP patients.

Discussion

- Previous results from animal, clinical and epidemiological studies suggest that OSA exacerbates cardio-metabolic risk in obese patients. However, it has been a challenge to determine if OSA is an independent risk factor or if it is an obesity epiphenomenon.
- Our study shows that obese subjects with OSA have higher rates of HTN and are more insulin resistant; however, these cardio-metabolic abnormalities are accounted for by advanced age and higher BMI alone, independent of the presence of OSA.
- Since CPAP compliance may lead to reduced hypoxemia and sleep disruption (which can attenuate the relationship to metabolic abnormalities), we did further analysis on a subset of patients stratified by CPAP compliance and AHI. As in the overall group, there was no difference in the prevalence of cardio-metabolic abnormalities nor an association with insulin resistance. However, there was a strong trend for a decline in β-cell function with increasing AHI that requires further investigation.

Conclusions

- OSA is not independently associated with overall cardio-metabolic health and insulin resistance in obese patients, even when accounting for CPAP compliance and AHI. However, severity of OSA (as measured by AHI) may be independently predictive of β-cell function.
- The strongest predictors of overall metabolic health are age and BMI, so that with higher BMI and more advanced age individuals are more likely to develop a metabolically abnormal profile.