Pilot study of Biomarkers for predicting obstructive sleep apnea (OSA) and effectiveness of CPAP treatment—correlation with Glucose Regulation

**Introduction**

Obstructive sleep apnea (OSA) is a known risk factor for metabolic disturbances, such as insulin-resistance type II diabetes mellitus. Continuous positive airway pressure (CPAP) therapy, the standard treatment for patients with OSA, may improve various metabolic variables, such as insulin sensitivity, glucose metabolism, lipids, fat distribution and adipokines. Several observational and uncontrolled studies claim an improvement of these metabolic variables through the use of CPAP. However, only a limited number of clinical randomized controlled trials (RCTs) have evaluated the effect of CPAP on metabolic variables, and even they remain inconclusive.

EENa's point-of-care specialty practice offers a unique OPPORTUNITY to research into biomarkers of OSA eliminating the time consuming and costly steps to randomize patient selection and to minimize bias. This practice based research takes advantage of its comprehensive electronic health record system (EHR) to facilitate participant recruitment and data collection, minimizing study overhead and streamlining the experience for patients.

The continued upward trend in the diagnosis of sleep disorders using polysomnography (PSG), provide a powerful argument for identifying biomarkers that can be used to demonstrate treatment efficacy or point-of-service cost-effective early detection.

The research objective of this study is to identify and develop a panel of biomarkers with measurable biochemical characteristics associated with the severity of OSA, and to evaluate the effect of CPAP on these variables. Of particular interest is a novel central regulator of glucose homeostasis.

**Methods**

**Study Population (Subjects):** Adult volunteer patients were recruited for the study. Overall well-being was assessed via a questionnaire survey at the beginning and at follow up during the study. Additionally data from health records were collected, recorded, analyzed and compared for changes in blood pressure, body weight, serum glucose and lipids, and urine glucose at initial diagnosis of OSA, before and after CPAP treatment. Data from volunteers without diagnosis of OSA were analyzed and used for sensitivity and specificity determination.

**Measurements:** The questionnaire survey assessment tool was divided into three sections: socio-demographic factors, anthropometric measures and biochemistry. The questionnaire gathered information on demographics such as age, gender, and educational background; risk factors of chronic diseases such as smoking, alcohol intake, diet and physical exercise; prevalence of chronic diseases including hypertension, diabetes mellitus, and dyslipidemia. The anthropometric measurements evaluated height, body weight as measured in the upright position to the nearest 0.5 cm and 0.1 kg respectively. Volunteers underwent measurement of neck or waist circumference taken at specified times throughout the study. Blood pressure for each subject was taken in the sitting position after 30 minutes of rest and recorded in their medical chart three times a month for the duration of the study. Subjects were asked to refrain from smoking, or ingesting alcohol and caffeine containing products a day before all BP measurements. Three readings each of systolic and diastolic blood pressure were recorded with an interval of five minutes at the least and the mean of each measure will be used for the data analysis.

**Biochemical analysis:** Sampling of easily accessible bodily fluids before and during CPAP treatment were collected by ACCESS LABS-Jupiter FL, for biochemical analysis.

**Hypothesis**

We hypothesize that OSA is associated with impaired glucose tolerance as a result of modifications of factors involved in glucose homeostasis or dysregulation of glucose homeostasis due to chronic sleep deprivation.

**Results**

1. There was a greater cumulative variation of neck circumference with systolic and diastolic pressures in the general pool of patients compared to patients with primary diagnosis of OSA.
2. Patients with primary diagnosis of OSA had a BMI greater than 27.53; however the BMI of OSA patients did not correlate with high BP.
3. Epworth Sleepiness Scale (ESS) was not a good predictive of OSA in patients, however a high BMI and BP was associated with a high AHI value.
4. Serum glucose and triglyceride were not reliable markers for predicting OSA.
5. Levels of DHEA, cortisol (pm) and 17-OH progesterone in saliva of patients diagnosed with OSA were significantly lower when compared to the normal reference ranges for each marker.

**Conclusions**

- While decrease in BMI & BP may be good indicators of lower AHI levels, serum glucose is not a good predictor of effective treatment with CPAP.
- Regular of glucagonogenesis may however be involved in the pathophysiology of OSA since preliminary data show changes in products of the adrenal cortex.
- Ongoing research is currently focused on a central regulator of glucose homeostasis as a biomarker and diagnostic tool to evaluate effectiveness of CPAP treatment of OSA.

**References**