

The Association of OSA with Chronic Medical Disorders and the effects of CPAP

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Overview

- What Happens during OSA
- Hypertension
- Pulmonary Hypertension
- Stroke
- Heart Disease and Sudden Death
- Gastroesophageal Reflux Disease – GERD
- Diabetes

What Really Happens During Obstructive Sleep Apnea

- Repetitive Upper Airway Obstruction for 30 – 60 seconds
- SpO₂ drops and CO₂ rises
- Initially BP drops then drifts upward
- Sympathetic surge and “awakening” with resumption of breathing
- Acute rise in BP (up to 80 mm systolic)

Continued

- Polysomnographic sleep study
- Apnea-Hypopnea index = # episodes/hour
- NL = up to 5 – 10
- Not unusual to have 50/ hour
- Fragmented sleep leads to daytime somnolence.
- Long term = Sympathetic activation, endothelial dysfunction, vascular oxidative stress, inflammation, increased coagulation, metabolic dysregulation.

Systemic Hypertension

- 70% of OSA patients are hypertensive
- Animal studies show cause and effect
- Normally HR & BP “dips” during sleep
- Association of OSA with “nondippers”
- Association of stroke and end-organ damage with nondippers

Wisconsin Sleep Cohort

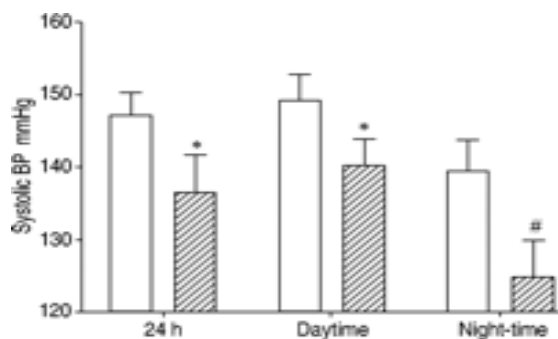
- Linear relation between apnea-hypopnea index and hypertension
- Even after adjustment for BMI, gender, waist and neck circumference, ETOH, and smoking
- Index > 15 meant three times greater risk of HTN.

AG Logan et al

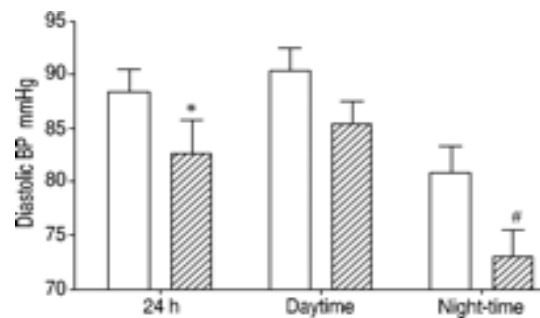
- 41 Patients with refractory hypertension and no existing dx of OSA
- Already on 3 anti-hypertensives
- Excluded secondary HTN or poor compliance with medication regimen
- Performed sleep studies
- 83% OSA,
- 95% of the males, 65% of the females

CPAP, OSA, and HTN

- Becker et al – Decrease of 10 mm in MAP (about the same as “one” antihypertensive)
- Logan et al = Refractory HTN and A-H index > 45
- Systolic down by 10, Diastolic down by 6



Significant drops in SBP (24hours, Daytime, and Night-time periods) from baseline after 2 months of nocturnal CPAP



Significant drops in DBP (24hours, Daytime, and Night-time periods) from baseline after 2 months of nocturnal CPAP

Pulmonary Hypertension

- Due to Hypoxic Pulmonary Vasoconstriction
- Directly proportional to duration and degree of desaturation through the night
- Studies show PHTN prevalence of 15%-53%
- Mild increase of 25 – 30 mm HG
- If greater degrees of PHTN present, look for something else.

CPAP, OSA and PHTN

- CPAP does lower PAP in OSA
- Arias et al – randomized crossover trial
- Mean decrease from 29 to 24 with biggest decrease in patients with PHTN or LV diastolic dysfunction

Stroke

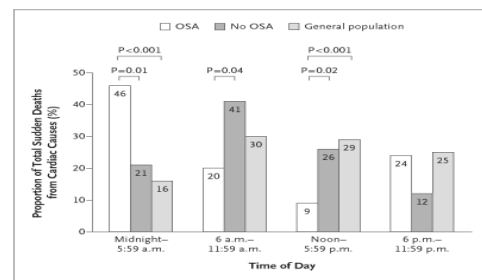
- Very strong association, perhaps as strong as association of stroke with smoking
- Sleep Heart Health Study – Direct relation between stroke and A-H index
- Mechanism ? – SpO₂ + CO₂ lead to cerebral vasodilation and CBF. Also endothelial dysfunction, vascular oxidative stress, elevated fibrinogen and platelet activation

CPAP, OSA, Stroke

- Improved outcome is not demonstrated
- Studies are small and tend to focus on “depressive symptoms”
- BP is definitely improved

Heart Disease and Sudden Death

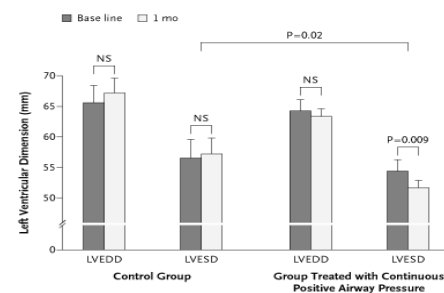
- One study 40-50% prevalence of OSA in patients with acute coronary syndrome
- Observed nocturnal ST changes with A-P episodes
- One study 37% of CHF patients have OSA
- Gami et al – 112 patients with sudden death + sleep studies
- 46% with OSA died 12MN – 6 AM
- Only 21% for those without OSA



Cardiac sudden death as function of time of day.
Diagnosis of OSA shifts time period to 12MN – 6 AM.

CPAP, OSA and Heart Disease

- Kaneko et al – 24 CHF patients (EF<45%)
- A-H index 37 to 45 (severe OSA)
- Randomized for one month of CPAP
- CPAP group EF increase from 25% to 34%
- No change in non-CPAP group
- Systolic BP dropped 10 mm in CPAP group
- Significant reduction in LVESD.



Significant reduction in LVESD (not LVEDD) with 1 month of CPAP

GERD and CPAP

- 50 – 75% of OSA patients have GERD
- Even when BMI is factored out!
- ? Negative intrathoracic pressure during A-H episodes pull contents from stomach
- CPAP in increasing pressure levels has been shown to decrease GERD.
- ? Does positive pressure on pharynx cause the esophagus to close

Diabetes

- Two studies = A-H index and low SpO₂ independently correlate with insulin resistance and glucose intolerance, independent of BMI.
- A-H index > 5 yields twice the risk of glucose intolerance
- A-H index > 15, diabetes > 15%
A-H index < 5, diabetes < 3%

Mechanism for OSA and Diabetes

- Association of sleep deprivation and diabetes thru appetite dysregulation and insulin resistance
- Intermittent hypoxemia stimulates release of catecholamines and cortisol resulting in glucose intolerance and insulin resistance
- CPAP – 6 of 13 studies showed beneficial effect, especially in low BMI patients (perhaps less weight dependent diabetes)

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