Cardiovascular disease and Sleep Disorders

- Timothy L. Grant, M.D., F.A.A.S.M.
- Medical Director Baptist Sleep Center at Sunset
- Medical Director Baptist Sleep Education Series
- Medical Director Sleep Division Miami Research Associates

Pearls to Remember

1) Consequences of OSA related to both arousals and hypoxia.
2) Arousals provoke increased sympathetic tone.
3) OSA may exist without snoring.
4) With difficult to control HTN and atrial fibrillation, look for occult OSA.

Medical Disorders Associated With Sleep Disturbances

- Cardiovascular Ds.
- Gastrointestinal Ds.
- Hypertension
- Endocrine Ds.
- Infectious Ds.
- Gastrointestinal Ds.
- Psychiatric Ds.
- Rheumatologic Ds.
- Neurological Ds.
- Menopause
- Chronic Pain
- ICU cases
- Intrinsic Respiratory Ds.
- Hematologic Ds.

Cardiovascular disease and OSA

- Hypertension
- Arrhythmias
- CHF
- Diabetes
- Pulmonary htn
- Obesity
- Metabolic Syndrome
- Syndrome Z
- Endothelial damage
- Vascular inflammation
- Oxidative stress
- Hypercoagulable state
- Obesity
- Non-dipping
- Sympathetic tone

Typical Progression of Sleep Over the Course of the Night

REM = rapid eye movement.

Dynamics of Sleep Architecture

- First part of the night
  - More slow wave sleep
  - More parasympathetic tone
  - More hemodynamically stable
  - More NREM parasomnias (i.e. sleep walking)
**Dynamics of Sleep Architecture**

- **Latter part of the night**
  - More REM sleep (sleep apnea is worse)
  - More sympathetic tone
  - More hemodynamically unstable
  - More REM disorders (i.e. REM sleep behavior ds, nightmares)

**Common Sleep Disorders**

Each can be associated with a myriad of medical disorders:

- Sleep Apnea (Obstructive and Central)
- Insomnia
- Periodic Limb Movements
- Restless Leg Syndrome
- REM Sleep Behavior Disorder
- Narcolepsy
- Hypersomnolence

**When is a PSG indicated?**

- Sleep Apnea
- Periodic Limb Movements (not RLS)
-potentially injurious nocturnal parasomnias
- Nocturnal Epilepsy with sleep complaint
- Precursor to f/u MSLT (daytime nap study)
- **Not insomnia** (unless suspect other sleep ds)

**Stop-Bang Questionnaire**

- Snoring
- Tiredness during daytime
- Observed Apnea
- High Blood Pressure
- BMI > 35
- Age > 50
- Neck Circumference > 40cm (15.75 inches)
- Male Gender

**Ask the patient (or bed partner):**

- Do you snore or stop breathing while asleep?
- Do you have leg movement before or during sleep?
- Do you exhibit any bizarre or violent behavior in sleep?
- Are you excessively sleepy during the day?

**Rationale for Treating Sleep Apnea**

1) Improved nocturnal sleep patterning
2) Awaken feeling more refreshed
3) Diminished Daytime Sleepiness
Rationale for Treating Sleep Apnea (cont.)

Prevention of:
- Hypertension
- Cardiovascular Disease
- Cerebrovascular Disease
- Diabetes
- Depression
- Nocturia
- Sexual Dysfunction
- Morning Headaches
- Gastroesophageal Reflux
- Cognitive Impairment
- Cancer

Probability of survival in patients with untreated OSA

Cardiac Related Sequellae of OSA
- Coronary artery disease, MI
- Cardiac arrhythmias
  - Atrial fibrillation, 1/3 with OSA, more successful cardioversion (80% vs 40%)
- CHF
- Hypertension 50%----50%
- Pulmonary hypertension
- Increased mortality

Sleep Apnea and Metabolic Syndrome
Metabolic Syndrome X
1) Hypertension
2) Glucose Intolerance
3) Hyperlipidemia
4) Obesity
- Syndrome Z (Metabolic Syndrome + OSA)

Basic Types of Apneas
- Obstructive Sleep Apnea (OSA)
  - Mechanical obstruction with continued effort to breathe
- Central Sleep Apnea (CSA/CSR)
  - Cheyne Stokes Respirations
  - No mechanical obstruction, No effort to breathe
- Mixed Sleep Apnea
  - Begins as a central and ends as an obstructive

Normal PSG, supine, in REM
Obstructive Sleep Apnea

The effects of OSA lead to a pathological cascade that is responsible for cerebrovascular and other cardiovascular diseases.

- Arousals from Sleep
- Hypoxia
- Hypercapnia
- Sleep Deprivation
- Negative Intrathoracic Pressure

Effects Of OSA

Pathologic Changes with OSA

- Sympathetic Activation
- Oxidative Stress
- Inflammation (plasma cytokines, TNF, IL-6)
- Endothelial Dysfunction
- Hypercoagulable State
- Metabolic Dysregulation

OSA and Cardiovascular Disease

- Increased sympathetic tone
- Chemoreflex stimulation
- Baroreflexes
- Mueller Maneuver
- Impaired venous return to the heart
- Changes in cardiac output

52 yo banker w/ prominent snoring and apneas observed by his wife, not him.
HTN, Hyperlipidemia, BMI: 32.89 + OSA = Syndrome Z

PSG

- 2004 AHI of 112
  - O2 76%
- 2011 AHI 105
  - O2 83%
- ESS = 8

CPAP

- CPAP 11cm,
  - AHI of 7, O2 96%.
- CPAP of 10cm,
  - AHI of zero, O2 95%
- ESS = 2
**CPAP**
IPAP = EPAP

**AUTO PAP (CPAP)**
IPAP=EPAP=Adjusting

**BIPAP**
IPAP higher, EPAP lower

**AUTO BIPAP (Bi-level)**
IPAP higher, EPAP lower, both adjusting

**VPAP/SERVOVENT**
EPAP stays the same, IPAP adjusts

**Coronary Artery Disease and OSA**
- Increased risk of MI and cardiovascular ds.
- Increased arousals
- Recurrent hypoxia
- Decreased coronary blood flow
- Negative intrathoracic pressure
- Systemic inflammation
- Coagulopathy
- Endothelial dysfunction
Central Sleep Apnea

- Central Sleep Apnea (CSA/CSR)
  - No mechanical obstruction
  - No Effort to breath

CSA associated with

- CHF
- Cerebrovascular disease
- Opiate usage
- High Altitude

Cheyne Stokes Respirations
A form of Central Sleep Apnea

51 yo College Administrator with “Complex/Central Sleep Apnea”
Labile HTN, CAD/stent, Cerebrovascular Ds

- AHI of 63
- REM zero w/o PAP
- Min O2 76 with 55 min < 90%
- Unresponsive to CPAP, and BiPAP
  - Event resolution,
  - O2 normalization and REM rebound w/ SVPAP/Servovent

Survival of heart failure patients with OSA

Arrhythmias in OSA

- Bradycardia
- Sinus pause
- Heart block
- Ventricular ectopy and tachycardia
- Atrial fibrillation
Obstructive Sleep Apnea
REM, O2 desaturations, 2 minutes

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Sinus Pause

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Supraventricular tachycardia in OSA

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Mechanism of arrhythmias in OSA

- Altered blood gases (hypoxemia, hyper & hypocapnia)
- Changes in autonomic tone
- Negative swings in intrathoracic pressure (which may distend the atria and ventricles)
- In the presence of coronary artery disease, the threshold for developing arrhythmias may be low.

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OSA and Atrial Fibrillation

- 3 million persons in US with AF 2005.
- Epidemiologic studies suggest OSA is a risk factor for new onset AF.
- OSA may confer worse prognosis for recovery after atrial fibrillation.

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OSA and Atrial Fibrillation

- 80% AF recurrence post cardioversion if untreated OSA.
- 50% of AF pts for cardioversion had OSA
- Increased AF post CABG if OSA
- Hypoxemia and obesity independent predictors of AF

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OSA and Hypertension

- **Sleep Heart Study**
  - Linear relationship between SBP and DBP and OSA severity.
- **Canadian population based study**
  - Each AH event per hour increased odds of HTN by 1%.
  - Each 10% reduction in nocturnal O2 sat increased likelihood of HTN by 13%.

SHHS, OSA, CAD, Heart Failure

- **Men with AHI >30 were 58% more likely to develop heart failure than those with AHI <5.**
  - **OSA predicts CAD in men <70**
  - **Men 40-70 with AHI > 30 were 68% more likely to develop CAD than those with AHI < 5.**
  - **OSA predicted incident of heart failure in men but not women.**

CPAP Treatment of OSA

- **Decreased Sympathetic arousals**
- **Normalizing dipping/non-dipping**
- **Lowers BP**
- **Favorable effect on AF recurrence, esp after cardioversion**

Pearls to Remember

1) Consequences of OSA related to both arousals and hypoxia
2) Increased sympathetic tone
3) OSA may exist without snoring (may also occur in nonobese, women, and young)
4) With difficult to control HTN and atrial fibrillation, look for occult OSA.

Bibliography

Bibliography

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Timothy L. Grant, MD, FAASM