Sleep Apnea: Advances in Diagnosis and Treatment to Lower CVD Risk

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- I have no relevant commercial relationships to disclose.
- All conflicts of interest of any individuals who control the content of this CME activity, including faculty and members of the Continuing Medical Education Committee and the Continuing Medical Education Department, have been identified and resolved.

Objectives

- Discuss the prevalence of sleep disordered breathing in cardiac patients and implement strategies to optimize treatment of sleep disorders in the cardiac patient.
- Recognize the various types of sleep disorders seen in the cardiac patient.
- Explain the benefits of sleep apnea treatment on overall cardiovascular health.

Sleep Disordered Breathing Pearls to Remember

1) Consequences of OSA related to both arousals and hypoxia.
2) Arousals provoke sympathetic tone.
3) OSA may exist without snoring or obesity.
4) With difficult to control HTN and atrial fibrillation, look for occult OSA.
5) Survival w/ SDB Rx intervention

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.

Common Sleep Disorders

Each can be associated with a myriad of medical disorders including CVD.

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

Disease:
- Hypertension
- Arrhythmias
- CHF
- Diabetes
- Pulmonary htn
- Obesity
- Metabolic Syndrome
- Syndrome Z

Mechanism:
- 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

Latter part of the night
- More REM sleep, sleep apnea is worse
- More sympathetic tone
- More hemodynamically unstable

Sleep deprivation/fragmentation from any cause can contribute to:
1) Diminished endothelial function
2) Increased BP
   - If < 5 hours, 2 X risk of HTN
3) Insulin resistance
   - decreased TST mimics DM
4) Increased risk of CAD (coronary art ds)
5) Obesity
   - Leptin and Ghrelin

Leptin and Ghrelin

2/5/2015

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Hormones that effect weight and appetite

- **Leptin**
  - From adipose cells (fat cells)
  - Normally signals satiety = “makes you feel full”

- **Ghrelin** (GI tract)
  - Signals increased appetite
  - Signals you to “eat”

Prevalence of Sleep Apnea

- **AHI > 5**
  - 29% men
  - 9% women

- **OSA (symptomatic)**
  - 4% men
  - 2% women

Increases with age and menopause.

Stop-Bang Questionnaire

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

- Score > 3 merits further sleep evaluation

Sleep Deprivation, Hormones and Weight Gain

- Decreased **Leptin**
  - If less, then you “feel less full”

- Increased **Ghrelin**
  - If more, then “increases your appetite”

Overall effect:
- less sleep = eat more = gain weight

Ask the patient (or bed partner):

- Do you snore, gasp, choke, 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?
- Do you have HTN, DM, CAD, CVD, DM?

A “yes” to any question may warrant further sleep evaluation.
Obstructive Sleep Apnea (OSA):
Manifestations
- Loud snoring
- Excessive daytime sleepiness (EDS)
- Awakenings: gasping, choking, snoring
- Poor memory and concentration
- Irritability or personality changes
- Morning headache or confusion
- Impotence, nocturia
- Floppy eye lids
- Edema

Rationale for Treating Sleep Apnea (cont.)
Prevention of:
- Hypertension
- Cardiovascular Disease
- Cerebrovascular Disease
- Diabetes
- Depression

SDB, Predictive Historical Data
- Male gender
- Ethnicity
- Age
- Menopause
- Macroglossia, retrognathia
- Obesity
- Neck Circumference (16 in. women, 17 men)

Cardiac Related Sequellae of OSA
- Coronary artery disease, MI
- Cardiac arrhythmias
- CHF
- Hypertension
- Pulmonary hypertension
- Increased mortality

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

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

- Syndrome Z (Metabolic Syndrome + OSA)
Normal PSG, supine, in REM

Pathologic Changes with OSA
- Oxidative Stress
- Inflammation (plasma cytokines, TNF, IL-6, CRP)
- Endothelial Dysfunction
- Thin walled atrium gets stretched
- Hypercoagulable State
- Impaired venous return to the heart
- Metabolic Dysregulation

Obstructive Sleep Apnea

Probability of survival in patients with untreated OSA

Effects Of OSA
- Sleep Deprivation
- Arousals from Sleep
- Hypoxia
- Hypercapnia
- Sympathetic Activation
- Negative Intrathoracic Pressure

OSA: How to decide whom to treat.
- Moderate to severe OSA, AHI ≥ 15
- Mild OSA 5-14 + comorbidities/clinical sx:
  - HTN, CAD, Arrhythmias, CVD, DM
  - EDS, neurocognitive ds, mood disorder
  - Insomnia
  - High risk occupation
FOR ALL CPAP PATIENTS CONSIDER:

- General Sleep Hygiene.
- Weight Loss.
- Off Back Positioning (positional tee shirt).
- Avoidance of nocturnal Etoh / sedation.
- Education as to risks of untreated SDB.
- Safety Issues regarding hypersomnolence.
- Compression stockings if edema.

**General Sleep Hygiene.**

**Oral Appliances**

**Mandibular Advancement Devices**

- Over 80 FDA approved devices
- A new device available which can be adjusted during PSG
- For mild – moderate OSA
- Risks of TMJ and altered dentition
- Need appropriate dentist follow up
- Need follow up PSG to validate efficacy

**Surgical Options for OSA**

- Septoplasty
  - May help snoring and airflow, but will not fully address OSA
- UPPP (Uvulopalatopharyngoplasty)
  - Very uncomfortable and poor efficacy
- Maxillo-Mandibular advancement
  - Extensive procedure, more successful
- Tonsillectomy
  - Very beneficial in children, not adults
- Hypoglossal Nerve Stimulation
  - advances the tongue with each inspiration

**Hypoglossal Nerve Stimulation**

- AKA: Sleep Apnea Pacemaker
- Proven failure on CPAP
- STAR Clinical Trial
- Special pharyngeal exam under anesthesia
- Eligible patients
  - Active psychiatric disease
  - Neuromuscular ds, hypoglossal nerve palsy
  - Severe COPD, mod-severe pulmonary hypertension
  - Heart disease or uncontrolled HTN
  - Sleep Apnea Pacemaker

**Sleep Apnea Pearls**

1. OSA may persist w/o snoring or obesity
2. Weight loss may help OSA even after subsequent weight gain.
3. Rx of OSA may decrease visceral fat area even w/o decrease in total body fat or subcutaneous fat.
4. Sildenafil citrate (Viagra) may exacerbate OSA.
5. OSA incidence in women increases after menopause.
6. Women may present with much more subtle symptoms than men, and mimic insomnia.
Tips on Increasing CPAP Compliance

- Patient and Family Education
- CPAP Desensitization, CPAP Nap evaluation
- Pressure change adjustment, Auto PAP, Servovent
- Change mask, nasal pillows, fabric mask
- Ramping
- Heated Humidification, Climate line
- Nasal steroids
- Mild sedation (i.e., nonbenzodiazepine)
- ENT evaluation for procedural intervention

CPAP = continuous positive airway pressure
IPAP = inspiratory positive airway pressure
EPAP = expiratory positive airway pressure

BIPAP (Bilevel)
IPAP higher, EPAP lower

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

AUTO PAP (CPAP)
IPAP = EPAP = Adjusting

VPAP/SERVOVENT
IPAP adjusts, EPAP stays the same
Coronary Artery Disease and OSA

- Increased risk of cardiovascular ds. and MI
- Recurrent hypoxia
- Decreased coronary blood flow
- Negative intrathoracic pressure
- Systemic inflammation
- Coagulopathy
- Endothelial dysfunction

Day-Night Variation of Sudden Cardiac Death
Mayo 7/87-7/03

- (midnight- 6 AM)
  - 46% OSA, 21% non OSA, 16% gen pop
- (6 AM- noon)
  - 20% OSA, 31% non OSA, 35% gen pop

12:00-17:59 (noon- 6 PM)
- 9% OSA, 20% non OSA, 21% gen pop
18:00-23:59 (6 PM- midnight)
- 24% OSA, 12% non OSA, 25% gen pop


Central Sleep Apnea

- Central Sleep Apnea (CSA/CSR)
  - No mechanical obstruction, open airway
  - No Effort to breathe

CSA associated with
  - CHF
  - Cerebrovascular disease
  - Opiate usage
  - High Altitude
Obstructive Sleep Apnea

Central Sleep Apnea

Cheyne Stokes Respirations

Sleep Health Heart Study
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

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 with events central
- Event resolution,
- O2 normalization and REM rebound w/ SVPAP/Servovent

CHF and OSA/CSA

- CSA common in CHF
- OSA common as well in CHF
- Moderate-severe OSA in 26-51% of CHF pts.
- Increased mortality if CHF w/ OSA or CSA
- Treatment of SDB (CPAP, BIPAP with back up rate, Servovent/Adaptive PAP):
  - Decreases sympathetic activation
  - Improves LVEF
  - Improves exercise capacity
Arrhythmias in OSA

- Bradycardia
- Sinus pause
- Heart block
- Ventricular ectopy and tachycardia
- Atrial fibrillation

Supraventricular tachycardia in OSA

Obstructive Sleep Apnea
REM, O2 desaturations, 2 minutes

- Altered blood gases (hypoxemia, hyper & hypocapnia)
- Changes in autonomic tone (increased sympathetic)
- 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.

Mechanism of arrhythmias in OSA

Sinus Pause

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.
30-50% of AF pts for cardioversion had OSA
80% AF recurrence post cardioversion if untreated OSA.
more successful cardioversion (80% vs 40%)
Increased AF post CABG if OSA
Hypoxemia and obesity independent predictors of AF
Rationale for aggressive treatment of SDB
Improved QOL
Improved daytime sleepiness
Decreased MVA’s
Decreased visceral fat
Decreased inflammatory markers
Improved glycemic control
Improved sympathetic arousals
Lowers BP
Decreased BP and CV events
Increased AF post CABG if OSA
Improved QOL
Improved survival
80% AF recurrence post cardioversion if untreated OSA.

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%

Patient population
OSA reduces mortality
OSA increases mortality

Pearls to Remember

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

Pearls to Remember

CPAP Treatment of OSA

• Decreased Sympathetic arousals
• Normalizing dipping/nondipping
• Lowers BP
• Favorable effect on AF recurrence, esp after cardioversion

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