Sleep and Heart Health: Consequences of OSA

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Objectives

• Explain the physiology of normal sleep
• Beneficial effects of sleep
• Examine disruptions in normal sleep as it affects the cardiovascular system
• Obstructive sleep apnea (OSA) as it affects sleep in Cardiovascular Disease
• Summary of OSA consequences on the heart and what you can do to prevent them!
April 20, 2011

MI After Non-Cardiac Surgery Are Often Overlooked

• POISE Trial (Perioperative Ischemic Evaluation)
  – 8351 patients in 190 centers in 23 countries were followed three days post non-cardiac surgery
  – Within 30 days of randomization, 415 patients (5%) showed evidence of perioperative MI.
  – ¾ occurred within 48 hours of surgery; 2/3 without symptoms
  – Looked for asymptomatic myocardial infarctions within 3 days after surgery using cardiac biomarkers.

• Conclusion the authors drew
  – Beta blockers reduce risk of MI but increase risk of severe stroke and overall death in patients undergoing non-cardiac surgery
  – “Surgery is the ultimate stress test.”
  – “Narcotics blunt the discomfort of the surgery but may mask the ischemic symptoms.”

MI After Non-Cardiac Surgery Are Often Overlooked

• Surgery = Anesthesia, patient asleep
• Adult population risk for obstructive sleep apnea ~ >4%

“We’re not optimizing medical therapy before surgery.” “There are existing guidelines and risk scores that are probably underused.”
Obstructive Sleep Apnea: The Elephant in the Cardiovascular Room

Jessie P. Bakker, Bhavneesh Sharma and Atul Malhotra

Chest 2012; 141:580-581
DOI 10.1378/chest.11-2178

The online version of this article, along with updated information and services, can be found online on the World Wide Web at:
http://chestjournal.chestpubs.org/content/141/3/580.full.html
Normal Sleep Architecture
<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
</tr>
</thead>
</table>
What happens when we sleep

<table>
<thead>
<tr>
<th>NREMS</th>
<th>FUNCTIONS</th>
<th>REMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENDOCRINE</td>
<td>BREATHING</td>
<td>CIRCULATION</td>
</tr>
<tr>
<td>GH early secretion</td>
<td>Ventilation</td>
<td>Heart rate</td>
</tr>
<tr>
<td>PRL early secretion</td>
<td>Reflexes proprioceptive</td>
<td>Blood pressure</td>
</tr>
<tr>
<td>ACTH late secretion</td>
<td>Chemoceptive</td>
<td>Cardiac output</td>
</tr>
<tr>
<td>T late secretion</td>
<td>Intercostal muscles</td>
<td>Reflexes proprioceptive</td>
</tr>
<tr>
<td>TSH inhibition</td>
<td>Upper airways muscles</td>
<td>Chemoceptive</td>
</tr>
<tr>
<td>Regular decrease</td>
<td>Variable amplitude</td>
<td>Variably arrhythmic</td>
</tr>
<tr>
<td>Effective</td>
<td>Overridden</td>
<td>Irregular oscillations</td>
</tr>
<tr>
<td>Effective</td>
<td>Overridden</td>
<td>Irregular oscillations</td>
</tr>
<tr>
<td>Active</td>
<td>Inactive</td>
<td>Overridden</td>
</tr>
<tr>
<td>Tone maintained</td>
<td></td>
<td>Overridden</td>
</tr>
<tr>
<td></td>
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<tr>
<td>Eurhythmic decrease</td>
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<td>Regular decrease</td>
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<td>Regular decrease</td>
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<tr>
<td>Effective</td>
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<tr>
<td>Effective</td>
<td></td>
<td></td>
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<tr>
<td>Decreased function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased urine flow</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GH, growth hormone; PRL, prolactin; ACTH, adrenocorticotropic hormone; T, testosterone; TSH, thyroid-stimulating hormone
Coronary Calcification and Sleep Times in Patients without OSA

- 495 patients (age 35-47) are screened with CT to look for coronary artery calcifications at baseline and again 5 years later.
- Sleep measurements with wrist actigraphy looked at duration of sleep between the scans.
- Patients with sleep disorders were “theoretically” excluded using questionnaires (ESS, Berlin, etc) and common risk factors smoking, obesity, family history, HTN.
- 12.3% (61 patients) developed coronary calcifications and it was correlated with sleep time.

Coronary Calcification Incidence by Mean Sleep Duration

King, C. R. et al. JAMA 2008;300:2859-2866
Sleep and Physiology
What are some beneficial effects of sleep?

- Weight loss
- Preventing certain cancers
- Preventing cardiovascular disease
- Preventing mood disorders
- Improving GI function
- Immune system regulation (inflammatory and anti-inflammatory properties)
- Regulates endocrine system
The Airway

Normal Breathing
- Airway is open
- Air flows freely to lungs

Obstructive Sleep Apnea
- Airway collapses
- Blocked air flow to lungs
PSG
Prevalence of OSA

• 18 -20 million adults suffer from
  – symptomatic OSA
  – severe asymptomatic OSA

• 90% remain undiagnosed and untreated
Impact of OSA

• Decreased quality of life
• Carries an economic toll
  – Consume higher amounts of healthcare $$$ prior to diagnosis
    • Hospitalizations
    • Accidents
• Public safety issue
  – Drowsy driving
  – Accidents in the work place
Risk factors for OSA

- Family history
- Prior upper airway issues (cleft palate/surgery, laser procedures, radiation, large tonsils)
- Increasing age *highest during middle age
- Smoking
- Obesity
- Male gender
- Postmenopausal status
- Sedative hypnotic medications
- Alcohol
- Neck circumference (> 17 inches (43 cm in males)
- HTN (40%)
OSA is Linked to Multiple Conditions

- Cardiovascular (CV) disease
  - HTN, CHF, Pulmonary Hypertension, Cor pulmonale, CVA, Sudden death due to fatal arrhythmias, Atrial fibrillation, Nocturnal angina, MI, and others!
- Glucose regulation with type II diabetes
- Autonomic instability
- GERD
- Increased morbidity & mortality from co-morbid conditions
Sleep and the Heart
Complications of OSA
Prevalence of SDB among key cardiovascular disease groups

- Drug-resistant hypertension: 80%
- Atrial fibrillation: 50%
- Congestive heart failure: 50%
- Hypertension: 35%
- Coronary artery disease: 30%

Percentage of disease population experiencing SDB
Groups Considered “At Increased Risk” for Cardiovascular Events

• Nocturnal angina, ischemia, myocardial infarction (~250,000/yr), lethal arrhythmias or cardiac arrest at night (~47,500/yr)
• Atrial fibrillation (2.5M/yr)
• Family report of highly irregular breathing, excessive snoring, or apnea in patients with coronary disease (5-10M/yr)
• Long QT3 syndrome, Brugada syndrome, and sudden nocturnal death syndrome (SUNDS)
• Near-miss or siblings of sudden infant death syndrome (SIDS) victims
• Patients on cardiac medications (13.5M/yr)
Systemic Hypertension (HTN)

- Estimated 30% individuals with HTN remain undiagnosed
- 50 million Americans – 1 in 4 adults
- Effective medical control of BP will prevent or forestall complications
- Direct healthcare costs are $22B/year
Proposed Mechanisms of HTN in OSA

• Frequent arousals cause acute transient increases in blood pressure
• Hypoxemia
  – causes peripheral vasoconstriction
• Greater intrathoracic pressure from upper airway obstruction
  – Increased LV transmural pressure leading to increased afterload, increased venous return to RV, impedes LV filling during diastole and decreased LV stroke volume
• Morgan and coworkers measured an increased sympathetic outflow after the hypoxic stimulus was removed
• In OSA, increased sympathetic tone has been demonstrated in resting muscle compared to controls
Sleep disordered breathing and cardiovascular events: fatal vs. nonfatal

Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study

Central Sleep Apnea

• This is not obstructive sleep apnea and it is treated differently, risk factors overlap but others exist
  – Complications of cervical spine surgery, radiation or severe degeneration
  – Encephalitis, poliomyelitis
  – Neurodegenerative conditions such as Parkinson’s Disease
  – Primary hypoventilation syndromes (Pickwick Pattern)
  – Brainstem stroke

• Commonly seen with sedatives/hypnotics medications and very common with alcohol use

• Can be normal
  – hypercapnea threshold changes during sleep
  – Transitional sleep
SUMMARY
Cardiovascular Complications OSA

- Untreated severe OSA
  - Increased fatal and nonfatal events
- Increased apnea severity is associated with increased all-cause mortality in men < 50 years old
- OSA is associated with a 2x risk of stroke or death from any cause
- OSA is associated with heart failure
  - Patients that go untreated have increased risk of death
- Sleep Related Breathing Disorder (SRBD) is highly associated with HTN
Questions?

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Helpful Websites for Patients

- [www.sleepeducation.com](http://www.sleepeducation.com) (American Academy of Sleep Medicine)
- [www.healthysleep.com](http://www.healthysleep.com) (ResMed)
- [www.cpap.com](http://www.cpap.com) (CPAP.com/supplies and info)
- [www.womensheart.org](http://www.womensheart.org) (Women and Heart Dz)
- [www.sleepandyou.com](http://www.sleepandyou.com) (Sleep and Health)
- [www.understandingsleep.org](http://www.understandingsleep.org) (Harvard Sleep)
  - This is the one Mr. Shaquille O'Neal appeared in on video