Updates in Obstructive Sleep Apnea

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Disclosures

• I have no conflicts to disclose
OBJECTIVES

• Review OSA prevalence, update statistics
• Discuss Comorbid conditions
• Discuss state of art pathophysiologic mechanisms
• Review American Society Anesthesiology recommendations for screening
• Discuss evidence around CPAP for medical conditions
• Discuss evidence of cpap for risk reduction in perioperative care
MILD OSA:
Apnea Hypopnea index (AHI) >5 + symptoms

MODERATE OSA:
Apnea Hypopnea index >15

SEVERE OSA:
Apnea Hypopnea index >30

United States Prevalence of OSA

- Using AHI >5
  - 20-30% men, 10-15% women in US
- Using AHI >5 with symptoms or AHI >15
  - 15% men, 5% women in US
- Ethnicity plays a role
  - Higher AHI, AA males age <39 vs. Caucasians of same age
- Age
  - steady increase in prevalence with age up to about age 60 with plateau
- Gender
  - Men 2-3 times more likely that women

Young. WMJ 2009
Redline. Am J Respir Crit Care Med 1997
Peppard. Am J Epidemiol 2013
Population HEALTH burden of OSA

National Health and Nutrition Examination Survey (NHANES) BMI data combine with data from the North American Sleep study cohort

- In 20 years (1990 to 2010)
  **Overall prevalence of OSA has increased from 11% to 14%**

Major RISK FACTOR: WEIGHT

- 2010 Prospective study over 4 years in 700 subjects: Increasing weight by 10% = 6 fold increase in risk for OSA
  Pepperd JAMA 2000

- 2010 Population based study with Polysomnography: 1000 people with Moderate to Severe OSA
<table>
<thead>
<tr>
<th>BMI</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1</td>
</tr>
<tr>
<td>Overweight</td>
<td>2.6</td>
</tr>
<tr>
<td>Obese</td>
<td>10.5</td>
</tr>
</tbody>
</table>
  Tufik. Sleep Med. 2010

- 2015, retrospective review of Obese with Hypoxemia,
  - 80% had OSA.
High Prevalence of OSA: COMORBID CONDITIONS

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>OSA PREVALENCE</th>
</tr>
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<tbody>
<tr>
<td>Atrial Fibrillation</td>
<td>32-49% (5 X)</td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>30% (11X M/M post MI)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>35-80%*</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>12-53%</td>
</tr>
<tr>
<td>Stroke and TIA</td>
<td>60% (1.76 X mortality)</td>
</tr>
<tr>
<td>Diabetes (type 2)</td>
<td>50%</td>
</tr>
<tr>
<td>Polycystic Ovary Syndrome</td>
<td>30X</td>
</tr>
<tr>
<td>Chronic lung diseases</td>
<td>2X</td>
</tr>
</tbody>
</table>

Mehra. AJRCCM 2006
Peker. ERJ 1999.
Young. Sleep 2008
Sjostrom. Thorax. 2002
Ferrier Chest 2005
Vazir Eur J Heart Fail. 2007
Yumino. Cardiol. 2007
Gottlieb. Circulation 2010
Kaneko. Sleep 2003
Einhorn. Endocr Pract 2007
Heffner Chest 2012.
Greenberg-Dotan. Sleep and breathing 2014
ASSOCIATION VS CAUSATION?
Proposed Mechanisms: Cardiovascular dysfunction in OSA

Apnea
- ↑ Pit
- ↑ RV preload, ↓ LV preload
- ↓ LV stroke V, LV diast relax and filling

Intermittent hypoxemia
- ↑ Sympathetic drive
- ↑ Systemic BP
- ↑ ischemic events and arrhythmia
- ↑ NO and ↑ endothelin
- ↓ NO and ↓ endothelin

- Prothrombotic State:
  - ↑ PLT adhesion
  - ↑ fibrinogen
  - ↓ fibrinolysis
- ↑ PAP
- ↑ SVR & afterload
- Heart rate
- Cardiac myocyte hypertrophy and apoptosis

Cardiomyopathy

JACC 2008;52:686-717
Untreated severe OSA (AHI >30) have 2-3 fold increased all cause mortality risk independent of other risks.

Punjabi et al, PLOS Med 2009
CARDIOVASCULAR MORTALITY and MORBIDITY IN OSA

CVS related DEATHS


Nonfatal CV events

OR 2.87

OR 3.17

1066 men
Sleep Apnea

Sleep Fragmentation

Increased. Catecholamines

Increased Cortisol

Increased IL-6, and TNF alpha

Increased Leptin

Fall in adiponectin

Beta cell dysfunction
Insulin resistance

Glucose intolerance
Diabetes association to OSA

• Type 2 Diabetes and OSA
  – Animal and Human experimental models
    • Intermittent hypoxemia plus sleep fragmentation provide evidence of alteration in glucose metabolism
  – INCIDENT DIABETES in SEVERE OSA (AHI >30) 30% higher risk
    • Of 736 men followed, 9% developed diabetes over 4 years
      • Kendzerska T. Am J Respir Crit Care Med 2014; 190:218.
Schematic diagram summarising the functional consequences of visceral obesity in adipocytes, skeletal muscle, the liver and the vessel wall.

OSA association with Nonalcoholic fatty liver disease

Meta-analysis of 18 studies with >2000 subjects
• OSA present
  – 2-3 fold increased risk for NAFLD
  – independent from age, weight, gender.

• OSA + higher Transaminases, higher prevalence of NAFLD and fibrosis

Proposed mechanism
• Intermittent hypoxia causes hypoxia inducible factor 1 and 2 (HIF-1, HIF-2), nuclear factor-kappa B, unfolding protein response and hypoxic adipose tissue inflammation leading to unchecked inflammation.
  • Türkay C. Respir Care 2012; 57:244.
  • Minville C. Chest 2014; 145:525.
OSA and Perioperative risk
Using ICD-9 codes in surgical patients—
– OSA prevalence 7-10%.

UNDIAGNOSED OSA is common.
– Cardiac surgery 48%
– Bariatric Surgery 70%

PERIOP Cardiopulmonary complications with OSA

- 2012, 2013 meta-analyses
  - INCREASED periop Cardiac complications
    - Myocardial Infarction
    - Cardiac arrhythmias (esp Atrial fibrillation)
- 2011 database review of 6 million surgical cases
  - INCREASED Respiratory complications
  - General Surgery
    - Intubation/Mechanical Ventilation rates almost DOUBLE (10.8 vs 5.94%)
    - Aspiration Pneumonia (2.79 vs 2.05%)
    - Acute respiratory distress syndrome (3.79 vs 2.44%).
- 2014 meta-analysis 17 studies
  - OR 2.4 for acute respiratory failure
  - OR 2.46 ICU transfers
  - OR 1.63 Cardiac events

Memtsoudis, Anesthe Analg. 2011
ADDITIONAL Periop Risks in OSA

• Acute Renal Failure (OR 2.43)
• Wound hematomas/seromas (OR 1.36)
• Delirium postoperatively (OR 4.3)
• ICU transfer (OR 2.81)

• Longer hospital stay **6.8 vs 5.1 days** for joint arthroplasty

2012 Anesthesiology. Flink et al.
PERIOPERATIVE MEDICINE: NEW STANDARDS

• OSA Preoperative screening is recommended
  – by the American Society of Anesthesiologists, the American Academy of Sleep Medicine, and other international health safety organizations

• Most critical populations are:
  – OBESE (BMI >30)
  – Those undergoing bariatric surgery
  – Those with history of difficulty intubation or upper airway anatomy predicting difficulty intubation*
  – Medical Comorbidities with high association with OSA:
    • Diabetes
    • Hypertension
    • Congestive Heart Failure
    • Stroke
    • Hypothyroidism
QUICK SCREEN: STOPBang  >3 buys a screening test

- Do you **SNORE** loudly?
- Do you often feel **TIRED**, fatigued, or sleepy during the daytime?
- Has anyone **OBSERVED** you stop breathing (obstruction) during your sleep?
- Do you have or are you being treated for high blood **PRESSURE**?
- Are you obese/ very overweight – **BMI** more than 35 kg/m2?
- **AGE** over 50 years old?
- **NECK** Circumference >16 inches?
- Are you male **(GENDER)**?

Chung F et al Anesthesiology 2008 and BJA 2012
Are we making a difference with CPAP
Benefits of CPAP for Hypertension

Yes Maybe

• Meta-analysis finds reduction Net -2.6 mmHg
• Treatment Resistant HTN may benefit (MAP & DBP -3.2mmhg)
• Severe OSA (hypoxemia) more likely to show improved BP
• Longer trials demonstrate benefit (36 months)

Not really

• Only seemed to help those with coexisting uncontrolled HTN
• No change in SBP in same population
• Trials are too short (2-3 months) to see benefit of combination therapy
• Population heath benefit extrapolated from medication studies

Fava. CHEST 2014;145:762.
Duran-Cantolla. BMJ 2010;341:c5991
Barbe Am J Resp Crit Care Med. 2010;181:718-726
Robinson. Eur Respir J. 2006;27:1229-1235
Benefits in Coronary Artery Disease and CPAP

Yes Maybe

• Longer terms studies, decrease in fatal and nonfatal events on cpap over 10 years
• CPAP can alleviate ischemic changes on EKG, reduce nocturnal angina

Not really

• No randomized trials.

Marin. Lancet 2055;365:1046
Benefits in Heart Failure and CPAP

**Yes Maybe**
- Improves LVEF by 5%
- Improves walk distance, and catecholamine levels.

**Not really**
- No difference in overall survival
- Treating treatment emergent CSA with Adaptive Servo Ventilation increased all cause mortality (30 vs 24%)

Benefits in Atrial Fibrillation and CPAP

Yes Maybe

• Cardioversion failure reduced by 50% (82 vs 42%)
• CPAP use with Ablation (pulmonary vein isolation) reduced recurrence (63 vs 28%)
• Higher arrhythmia free survival rate off meds (66 vs 33%)

Not really

• Observational studies
• Need prospective studies.

Ng Am J Cardiol. 2011;108:47-51.
<table>
<thead>
<tr>
<th>Yes maybe</th>
<th>Not really</th>
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<tr>
<td>• Nondiabetics improve glucose tolerance with cpap</td>
<td>• No consistent improvement in glucose control in DM</td>
</tr>
<tr>
<td>• Short term study improved glucose tolerance in PREdiabetes</td>
<td>• Well designed long term studies are needed</td>
</tr>
</tbody>
</table>

OSA PERIOPERATIVE RISK and CPAP

Yes Maybe

• Meta-analysis. Decreased rate of ICU/respiratory events. NNT 45
• Decrease atrial arrhythmia
• Decreases rostral fluid shifts
• Offsets effects of sedatives/narcotics on airway tone
• Shorter hospital stay (0.4 days)

Not really

• Risk most pronounced 3 days after operation
• No study confirms negative effect specific to OSA patients
• Adherence in postop period is low

Nagappa. Anesth Analg. 2015;120:1013-1023
Take Home points

• OSA prevalence is on the rise
• Comorbid medical conditions increase likelihood OSA
• Severe OSA is associated w. CV morbidity and mortality
• Diabetes, like metabolic syndrome more common in OSA
• Severe OSA look for NALD, risk for progression to cirrhosis
• Preoperative assessment for OSA now a new MANDATE
• Medical Benefits from Treatment best established in severe sleep apnea
Thank you