Sleep Evaluation in Newly Discovered OSA In and After Hospital

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Medical Director, Stanford Sleep Medicine Center
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• Sleep evaluation in newly discovered OSA in patients during hospitalization
• Sleep evaluation in newly discovered OSA in patients after hospitalization
• Management of OSA in patients during and after hospitalization
• What about the future?

Alzheimer’s Disease: OSA

OSA is found in 33-53% of patients with probable Alzheimer’s Disease

APOE4 genotype: Risk factor for SDB in the middle-aged Wisconsin Sleep Cohort Study, but not in the elderly Honolulu-Asian Study cohort

Stroke

- Stroke can result in SDB, including central and obstructive apnea and disorders of respiratory control.
- SDB is the most commonly reported disturbance post-stroke, although adults are observed to have a high incidence of periodic breathing and Cheyne-Stokes respiration.
- Patients post-stroke have a high OSA prevalence (60-93%). In a meta-analysis of 2343 subjects with ischemic or hemorrhagic stroke or TIA, OSA was present in 72%, with only 7% due to central apnea.

Cardiovascular Disease

- About 50% of OSA patients are hypertensive, and an estimated 30% of hypertensive patients also have OSA, often undiagnosed.
- OSA was detected in 37% of 450 and 11% of 81 patients with heart failure resulting from systolic dysfunction referred for polysomnography.
- OSA in patients with CAD ranges from 26% to 66%, partially explained by the different AHI cutoff scores.

- Sleep evaluation in newly discovered OSA in patients during hospitalization
  - Prevalence of OSA in patients with chronic medical conditions
  - What evidence-based tools can be used to evaluate OSA in hospitalized patients?
  - What else can improve the pretest probability for detecting OSA in hospitalized patients?
• Questionnaires (e.g., STOP-Bang) have high sensitivity to predict OSA (AHI ≥ 15 or ≥ 30 events/hour: 93 and 100%, respectively).¹

• “The strength of evidence is low that some clinical prediction rules may be useful in the prediction of a diagnosis of OSA.”¹

• Age, sex, body mass index, bed partner observation of apnea and pharyngeal examination can be significant predictors of AHI.²

• Trained and experienced sleep physicians are best suited to evaluate and treat OSA patients.

Pre-Test Probability for Moderate to Severe OSA

- to predict OSA (AHI ≥ 15 or ≥ 30 events/hour: 93 and 100%, respectively).¹

Questionnaires vs. PSG

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  • Prevalence of OSA in patients with chronic medical conditions
  • What evidence-based tools can be used to evaluate OSA in hospitalized patients?
  • What else can improve the pretest probability for detecting OSA in hospitalized patients?

“...and on the box sat a fat and red-faced boy, in the state of somnolency.” C. Dickens

OSA Predisposing Factors
• Age (40 - 60 years)
• Male Gender (8 : 1 male : female)
• Hypothyroidism
• Medications, Alcohol
• Obesity
• Anatomic Abnormalities
Contributors to an Abnormal Upper Airway

- Excess, erythematous pharyngeal tissue
- Enlarged, erythematous uvula
- Macroglossia
- Congested nasal passages
- Low-lying soft palate
- High arched hard palate

Craniofacial Dysmorphism and OSA

- Infants with apneas had family members with OSA, and small upper airways were a common familial feature
- Relatives of OSA patients reported more OSA symptoms and sleep-related breathing disorders, plus more evidence of craniofacial dysmorphism, compared to controls

Management of Obstructive Sleep Apnea
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Craniofacial Dysmorphism
Due to Non-Genetic Factors

- Early problems with nasal breathing such as nasal allergies have a negative impact on upper airway development.
- The increase in nasal resistance can halt growth of the maxillo-mandibular skeleton, and induced changes in the naso-maxillary, mandible, and pharyngeal airway space.
- Development of mouth breathing in association with an increase in nasal resistance, leads to mouth opening and mouth breathing during the day and night.
- This obligate mouth breathing and alteration in craniofacial growth are associated with OSA.


- A tendency to have a retruded mandible (p=0.05)
- A greater inclination of the mandibular and occlusal planes (p<0.01)
- A tendency to have greater inclination of the upper incisors (p=0.08)

Juliano ML. Mouth breathing children have cephalometric patterns similar to those of adult patients with obstructive sleep apnea syndrome. Arch Otolaryngol 2003;129(9):985-9.
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Patient presents to BCSS for evaluation of suspected OSA

Does patient have a high pretest probability of moderate to severe OSA?

Does patient have symptoms or signs of co-morbid medical disorders?

Does patient have symptoms or signs of co-morbid sleep disorders?

Sleep Study (HST or in-lab PSG)

HST

In-lab polysomnography

OSA diagnosed?

YES

NO

NO

YES

OSA diagnosed?

YES

NO

NO

YES


Out-of-Center Sleep Testing Decision Tree

Out-of-Center Sleep Testing

Does your Sleep Center Administer Out-of-Center Sleep Tests?

Sleep Review. Third Quarter 2015 Sleep Center Survey Results (327 responses between 7/22/2015 and 8/10/2015), September 2015. sleepreviewmag.com
• Sleep evaluation in newly discovered OSA in patients **during** hospitalization
• Sleep evaluation in newly discovered OSA in patients **after** hospitalization
• Management of OSA in patients **during** and **after** hospitalization
• **What about the future?**
  • What are OSA management options for patients prior to and following discharge from the hospital?

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**Treatment for Snoring** and OSA

- PAP
- Surgery*
- Oral Appliances*
- Nasal Valves and Stents*
- Negative Pressure Devices
- Weight Loss*
- Behavior Modification*
- Medications

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**Devices**

- **CPAP** (continuous positive airway pressure): delivers single, fixed pressure
- **BPAP** (bilevel positive airway pressure): delivers inspiratory and expiratory pressures with or without backup rate
- **APAP** (auto-titrating positive airway pressure): delivers pressure based on flow signal at almost a breath-to-breath basis
- **ASV** (adaptive pressure support servo-ventilation): delivers a small but varying amount of ventilatory support
Fixed CPAP vs. APAP

- Statistically but not clinically significant difference of 11 minutes of added use per night with APAP
- Analysis of 147,402 days of SmartCard data
- Most dense usage between 300 – 500 min
- Red circles indicate outliers for analyses

CPAP Therapy and Daytime Sleepiness
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CPAP Therapy and HTN


NCF in OSA Patients

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Study Type</th>
<th>n OSA</th>
<th>Severity</th>
<th>Conclusions</th>
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<tbody>
<tr>
<td>Barbé</td>
<td>2001</td>
<td>RCT</td>
<td>29/25</td>
<td>severe</td>
<td>no difference in Active vs. Sham CPAP groups for A/P, L/M, and E/F tests</td>
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<td>Bédard</td>
<td>1991</td>
<td>CC</td>
<td>20/10</td>
<td>mod-severe</td>
<td>decrease* in 7/9 A/P and 2/4 E/F tests; decrease* in 5/6 L/M tests (only severe cases)</td>
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<tr>
<td>Cheshire</td>
<td>1992</td>
<td>CS</td>
<td>29</td>
<td>mod-severe</td>
<td>correlation* between AHI and 1/2 EF tests and IQ decrease; no correlation in 3 A/P or 1 L/M tests</td>
</tr>
<tr>
<td>Findley</td>
<td>1986</td>
<td>CS</td>
<td>26</td>
<td>severe</td>
<td>decrease* in 4/8 A/P, L/M, and E/F tests for hypoxemic vs. non-hypoxemic OSA subjects</td>
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<tr>
<td>Greenberg</td>
<td>1987</td>
<td>CC</td>
<td>14/14</td>
<td>severe</td>
<td>decrease* in 7/14 A/P and E/F tests vs. controls</td>
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<tr>
<td>Ingram</td>
<td>1994</td>
<td>CC</td>
<td>16/43</td>
<td>mild-severe</td>
<td>no difference in OSA vs. controls subjects; ≥54 yrs for 1 A/P test</td>
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<tr>
<td>Kim</td>
<td>1997</td>
<td>CH</td>
<td>199/642</td>
<td>mild-severe</td>
<td>negative association* between log AHI and psychomotor efficiency in 8 A/P, L/M, or E/F tests</td>
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<tr>
<td>Naëgelé</td>
<td>1995</td>
<td>CC</td>
<td>17/17</td>
<td>severe</td>
<td>decrease* in 1/4 A/P tests, 8/10 L/M tests, and 3/9 E/F tests vs. controls</td>
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<tr>
<td>Presty</td>
<td>1991</td>
<td>CS</td>
<td>119</td>
<td>mild-severe</td>
<td>decrease* in A/P and L/M tests for those OSA patients with severe hypoxia</td>
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<tr>
<td>Redline</td>
<td>1997</td>
<td>CC</td>
<td>32/20</td>
<td>mild-mod</td>
<td>decrease* in 1/4 A/P tests and 1/5 E/F tests; no difference in 3 L/M tests vs. controls</td>
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<tr>
<td>Telakivi</td>
<td>1993</td>
<td>CS</td>
<td>31</td>
<td>mild-severe</td>
<td>no correlation between hypoxia or sleepiness and 7 A/P, L/M, and E/F tests</td>
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<tr>
<td>Verstraeten</td>
<td>1996</td>
<td>CC</td>
<td>26/22</td>
<td>mild-severe</td>
<td>no differences in OSAS vs. insomnia subjects for 6 A/P, L/M, or E/F tests</td>
</tr>
</tbody>
</table>

*Significance Level: p < 0.05; Study Type: RCT = randomized control trial; CC = case-control, CH = cohort; CS = case series; n: cases/controls (if applicable); OSA Severity by average Apnea-Hypopnea Index (AHI), with mild = 5 - 15 events/hr, moderate = 15 - 30 events/hr, and severe > 30 events/hr; Test Type: A/P = tests of attention and psychomotor function, L/M = tests of learning and memory, E/F = tests of executive and frontal-lobe function

CPAP Adherence-Adjusted Primary Neurocognitive Outcomes
OA vs. PAP

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OA vs. PAP

Parallel/First Arm Crossover Studies

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<th>PAP</th>
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<tr>
<td>Lim J</td>
<td>10</td>
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Crossover Studies

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<th>PAP</th>
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Healthcare Transformation

• The practice of medicine is transforming to become more:
  o Efficient
  o Adaptable
  o Cost-Effective
  o Multidisciplinary
  o Patient-Centered
SMART DOCS Goals

- To introduce a new Patient-Centered Outcomes and Coordinated-Care Management (PCCM) approach for the future practice of sleep medicine
- To compare the PCCM approach to conventional (CONV) sleep medicine practice in a clinical trial evaluating:
  - Patient ratings of health care performance
  - Disease-specific outcomes
  - Global health measures
  - Health care utilization

Overall Study Sample

Randomized Clinical Trial
Includes new adult patients with signs/symptoms of a sleep disorder

1,836 Participants
56.5% Male
Average Age: 50.1 years

Comparison between Conventional Diagnostic and Treatment Approach and Patient-Centered Outcomes and Coordinated-Care Management Approach:
- Conventional Approach: 50.1%
- PCCM Approach: 49.9%
PCCM Approach

- Using newer sleep medicine tools and technologies
  - More effective sleep disorder management
    - Examples:
      - Continuous blood pressure monitoring
      - Wearable technology to track sleep-wake patterns

- Utilizing sleep medicine professionals in a primary care setting
  - Expedite diagnosis and treatment at front lines of care
    - Example:
      - Establish a sleep disorder practice within primary care

PCCM Approach

- Facilitating collaboration among sleep specialists, providers, patients, medical professional organizations, and industry
  - Stakeholder engagement for improved patient care
    - Example:
      - Input on content/design for personalized patient materials

- Providing patients with better access to information, resources, and data about sleep disorders, comorbidities, treatments, and personal health information
  - More informed health care decisions
    - Example:
      - Patient portal – sleep portal

PCCM Sleep Education

- Patient Portal – Sleep Disorders
Obstructive Sleep Apnea

- includes branching logic and clinician report
- We use mainly out-of-center sleep testing (OCST) devices with ambulatory blood pressure monitoring for those who have borderline or definitive hypertension
- For those with high predictive probability for diabetes, measure glucose, insulin, and lipid levels
- Genetic markers (e.g., ApoE4) will be tested
- Adherence measures are uploaded to the web portal

Blood Pressure Monitoring
Obstructive Sleep Apnea

- Patients prescribed oral appliances have their probability of success and their target protrusive position assessed by the MATRx device
- There are integrated adherence monitoring devices in the OAs
- OA efficacy is evaluated with the OCST devices or in-lab polysomnograms
- OA efficacy and adherence data are placed on the web portal

Oral Appliance Titration

Adherence Measures

Tools and Technologies

- Alliance Sleep Questionnaire
- Greater use of OCSTs
- Ambulatory blood pressure assessments (SOMNOtouch)
- Oral appliance titration (MATRx)
- Oral appliance adherence assessment (TheraMon)
- Sleep-wake patterns, fitness, nutrition (Jawbone UP24)
- Cognitive behavioral therapy for insomnia (SleepRate)
- Salivary dim light melatonin onset (DLMO)
- Diabetic risk assessment, inflammatory markers
- Genetic markers
Primary Care

Sleep physician, nurses, and technologists at PCP office to:
• Assist in patient evaluation and referral decisions
• Order and set-up home sleep studies at PCP office
• Promptly attend to management issues, e.g., suboptimal adherence, CBTi instruction

Coordinated Care

• Sleep technologists with Certification in Clinical Sleep Health™ (CCSH) “work directly with sleep medicine patients, families, and practitioners to coordinate and manage patient care, improve outcomes, educate patients and the community, and advocate for the importance of good sleep.”
• Contact patients within one week after sleep studies and after receiving PAP to address any questions or issues.

Outcomes

Impact on Improved Health Care Performance

Primary Endpoint: Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey (CGCAHPS) Global Provider Rating
Secondary Endpoint: Items on “How Well Providers (or Doctors) Communicate with Patients”
Secondary Endpoint: Items on the CGCAHPS Health Information Technology Item Set

Impact on Cost Containment
Secondary Endpoint: Out-of-pocket costs
Outcomes

**Impact on Improved Health**
- Primary Endpoint: SF-36 Vitality Component Score
- Secondary Endpoint: SF-6D Health Utility index
- Secondary Endpoint: FOSQ-10
- Secondary Endpoint: SF-36 Physical Component Score
- Secondary Endpoint: Alliance Sleep Questionnaire (ASQ)
- Disorder Specific Measures
  - Epworth Sleepiness Scale (ESS, normative value 12.0 ± 4.0)
  - Insomnia Severity Index (ISI, normative value 20.0 ± 5.0)
  - International Restless Legs Syndrome Study Group Rating Scale (IRLS, normative value 22.0 ± 8.7)

**SMART DOCS**
SMART DOCS: A New Patient-Centered Outcomes and Coordinated-Care Management Approach for the Future Practice of Sleep Medicine
- Article aims to stimulate discussion in the sleep community
- Introduces new PCCM approach
- Describes testing of PCCM vs. Conventional approach