Sleep Disorders: Assessment and Therapeutic Options

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Overview

- Sleep apnea
  - Diagnosis, treatment options, complex apnea
- Insomnia
  - Phenotypes, misperception, treatment options
- Other sleep disorders
  - Narcolepsy, Restless Legs, parasomnia, circadian delay
Obstructive Sleep Apnea (OSA)

AHI = apneas and hypopneas per hour of sleep

- 0-5 Normal
- 5-15 Mild
- 15-30 Moderate
- >30 Severe

30 sec
Evolution of Sleep Apnea Practice

Historical Standard of Care
- Treat only if elevated AHI + symptoms (e.g., sleepiness)
- No treatment if asymptomatic, even with severe apnea

Modern Standard of Care
- Increasing links to cardiac, stroke, death, car accidents
- Treat moderate or severe OSA, regardless of symptoms
- Treat mild OSA if sleep symptoms or co-morbid disease

Emerging Trends
- Home sleep devices for diagnosis and auto-titrating CPAP
- Insurance prior authorizations reducing lab usage
- Recognizing complex apnea
Why OSA still remains undiagnosed…

- Even among those with severe OSA, half will:
  - have no subjective sleepiness
  - have normal Epworth Sleepiness scores
  - have normal objective sleep latency (MSLT)

- The most common clues, snoring and obesity, explain <25% of the variance in apnea severity

- Even clinical impression of sleep specialists has sensitivity & specificity ~70% (Skomro, 1999)

- Demographics and co-morbidities, rather than symptoms, carry predictive value (Ustun, Bianchi, in press)
## Epworth Sleepiness Scale

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of Dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
</tr>
<tr>
<td>Sitting inactive (in a public place)</td>
<td></td>
</tr>
<tr>
<td>Passenger in a car for 1 hour</td>
<td></td>
</tr>
<tr>
<td>Lying down to rest in afternoon</td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch (no ETOH)</td>
<td></td>
</tr>
<tr>
<td>When stopped in traffic for a few min</td>
<td></td>
</tr>
</tbody>
</table>

0 = no chance  
1 = slight chance  
2 = moderate chance  
3 = high chance
If we can’t trust symptoms to predict sleep apnea, then what?

We can’t test everyone (yet)…
### Solution: Be a Bayesian!

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Adult Population</td>
<td>5-20%</td>
<td>Kapur (2010)</td>
</tr>
<tr>
<td>Gen Surg outpatients</td>
<td>65%</td>
<td>Chung (2008)</td>
</tr>
<tr>
<td>Refractory Epilepsy</td>
<td>30-80%</td>
<td>van Golde (2011)</td>
</tr>
<tr>
<td>HTN requiring 3 drugs</td>
<td>&gt;60%</td>
<td>Logan (2001)</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>35%</td>
<td>Sin (1999)</td>
</tr>
<tr>
<td>Bariatric clinic</td>
<td>80%</td>
<td>Lopez (2008)</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>30-60%</td>
<td>Bassetti (2006)</td>
</tr>
<tr>
<td>Down syndrome</td>
<td>60%</td>
<td>Marcus (1991)</td>
</tr>
<tr>
<td>Diabetes (type 2)</td>
<td>50%</td>
<td>Aurora (2013)</td>
</tr>
</tbody>
</table>

Bianchi (2009) Screening for OSA: Bayes Weighs In
**Polysomnogram options for sleep apnea**

<table>
<thead>
<tr>
<th><strong>Test Type</strong></th>
<th><strong>Considerations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnostic</strong></td>
<td>➢ Most information (sleep stages, body position)</td>
</tr>
<tr>
<td></td>
<td>➢ Increased time to treatment if OSA</td>
</tr>
<tr>
<td><strong>Split-Night</strong></td>
<td>➢ Trial PAP if OSA criteria is met</td>
</tr>
<tr>
<td></td>
<td>➢ Accelerates treatment path</td>
</tr>
<tr>
<td></td>
<td>➢ Less Dx/Rx time = more uncertainty</td>
</tr>
<tr>
<td><strong>Full Night Titration</strong></td>
<td>➢ Maximize time for testing pressures, masks, CPAP vs BiPAP, across sleep stages and body positions</td>
</tr>
</tbody>
</table>
Example: Split-Night PSG report

- **O₂**: Oxygen saturation levels showing variability throughout the night.
- **Apneas**: Graph displaying episodes of apnea, represented by horizontal bars.
- **Stage**: Stages of sleep indicated with different rhythms, with N1, N2, N3, and W (Waking).
- **PAP**: Positive Airway Pressure settings, with levels of 0.00, 2.00, 4.00, 6.00, and 8.00.

The diagram captures a comprehensive overview of sleep patterns and respiratory status during a split-night polysomnography (PSG) report.
Example: Split-Night PSG report

<table>
<thead>
<tr>
<th>Respiration Events</th>
<th>Diagnostic</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sleep Time (min.):</td>
<td>141.5</td>
<td>223</td>
</tr>
<tr>
<td>Number of Obstructive Apneas:</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Number of Mixed Apneas:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of Central Apneas:</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Number of Hypopneas*:</td>
<td>137</td>
<td>17</td>
</tr>
<tr>
<td>Number of Apneas + Hypopneas:</td>
<td>152</td>
<td>20</td>
</tr>
<tr>
<td>Apnea Index:</td>
<td>6.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Hypopnea Index:</td>
<td>58.1</td>
<td>4.6</td>
</tr>
<tr>
<td>Apnea-Hypopnea Index (AHI):</td>
<td><strong>64.5</strong></td>
<td><strong>5.4</strong></td>
</tr>
<tr>
<td>Number of RERAs:</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>RDI:</td>
<td>65.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Continuous Oxygen Saturation, mean value:</td>
<td>75.5</td>
<td>91.5</td>
</tr>
<tr>
<td>Minimum Oxygen Saturation During NREM</td>
<td>50</td>
<td>88</td>
</tr>
<tr>
<td>Minimum Oxygen Saturation During REM</td>
<td>N/A</td>
<td>89</td>
</tr>
<tr>
<td>O2 Desaturation:</td>
<td>141</td>
<td>16</td>
</tr>
<tr>
<td>O2 Desaturations Index:</td>
<td>42.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Hypoventilation:</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cheyne Stokes Breathing:</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Total Time ≤ 88% (min.):</td>
<td></td>
<td><strong>61.7</strong></td>
</tr>
</tbody>
</table>

* Definitions:

1. “Hypopnea” is defined as > 30% decrease in airflow or respiratory effort, by nasal pressure signal excursion, lasting ≥10 seconds, in association with a 4% or greater oxygen desaturation
2. “apnea” is ≥90% drop in thermal sensor excursion lasting ≥10 seconds.
Obstructive vs Central Apnea

Apnea  Recovery breaths  Continued Effort

1 min  1 min
Example: Split-Night PSG, complex apnea
Types of Positive Airway Pressure

- **CPAP**: continuous pressure
- **BiPAP**: 2-level: insp > expir
  - comfort
  - hypoventilation
- **Auto-PAP**
  - range of pressures
  - adjusts in real time
- **Adaptive “ASV” system**
  - Complex apnea
CPAP alternatives

Oral Appliance (dentist)

Jaw Surgery (OMFS)

Palate Surgery (ENT)

Provent Valves
Newly Approved: Tongue Stimulator

- Drug induced sleep endoscopy to enroll
- Open label, no control arm
- BMI<32, AHI 20-50
- Non-positional
- 1y follow-up
- 70% success* (*mild AHI persisted)

Strollo et al 2014 NEJM

Figure 1. Upper-Airway Stimulation.
Position Therapy

“zzzoma”

Other examples:

- Tennis balls sewn into shirt
- Wedge pillow
- Neck alarm: (Levendowski, 2014)
What *doesn’t* work (in isolation)

- Special pillows
- Chin strap
- Breathe-right strips
- Nasal sprays
- Tongue exercises
- Deviated septum repair
- Sinus surgery
- “Lose 10 lbs”
- Oxygen
OSA Follow-up & Management Topics

- DME companies handle supplies/refills

- Insurance increasingly requires objective compliance data from the machines (“4hrs, 70% of nights”)

- CPAP pressure change may be needed if:
  - 10% or more weight change (up or down)
  - Data card shows ongoing apnea
  - Snoring, gasping, etc resumes

- 60% remain compliant at 1-year; consider alternatives
Home vs Lab Testing
Limited-channel home apnea kit examples

- NovaSom
- ApneaLink
- WatchPAT
- EMBLA
- ARES
Clinical Guidelines for the Use of Unattended Portable Monitors in the Diagnosis of Obstructive Sleep Apnea in Adult Patients

Portable Monitoring Task Force of the American Academy of Sleep Medicine

Obstructive Sleep Apnea Devices for Out-Of-Center (OOC) Testing: Technology Evaluation

Nancy A. Collop, M.D.¹; Sharon L. Tracy, Ph.D.²; Vishesh Kapur, M.D.³; Reena Mehra, M.D., M.S.⁴; David Kuhlmann, M.D.⁵; Sam A. Fleishman, M.D.⁶; Joseph M. Ojile, M.D.⁷

Practice Parameters for the Use of Autotitrating Continuous Positive Airway Pressure Devices for Titrating Pressures and Treating Adult Patients with Obstructive Sleep Apnea Syndrome: An Update for 2007

An American Academy of Sleep Medicine Report

(Re-affirmed content in UpToDate as of July 2015)
<table>
<thead>
<tr>
<th>American Academy of Sleep Medicine Guideline Topics</th>
<th>HPHC / Care-Core</th>
<th>BCBS / AIM</th>
<th>Cigna / Care-Centrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central/complex apnea</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>CHF, COPD, NMJ, cognitive impairment</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>80% pre-TP of AHI&gt;15</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Insomnia (contra-indication for home)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PLMS (reason for in-lab)</td>
<td>No</td>
<td>✅</td>
<td>✅</td>
</tr>
</tbody>
</table>
The intention of home testing is to “rule in” high suspicion cases of significant OSA (moderate or severe).

If the home device is negative, in-lab PSG is recommended to confirm (due to false negative risk).

If used for screening, i.e., in low-probability cases, two errors occur:

1) false negatives (algorithms under-estimate AHI)
2) false-positives (by Bayes’ Theorem)
Insomnia
Insomnia Phenotypes

New Criteria:

Acute vs Chronic

Circadian

Sleep Hygiene

Adjustment

“Primary”

Medical Dx

Misperception

Psychophysiologica

Psych Dx
Insomnia: Sleep-Wake Misperception

- Tendency to OVER-estimate onset latency
- Tendency to UNDER-estimate total sleep time

Subjective:

Latency: 45 min
Total: 4.5 hrs
Misperception insomnia: what is known?

Of the ~30 million chronic insomniacs in USA:

- “Extreme” misperception in ~5%
- “Spectrum” misperception more common (~50%)
- Predictors and mechanisms are unclear
- Prospective epidemiology suggests insomnia morbidity only if objective short sleep on PSG

Harvey and Tang 2011; Vgontzas 2013)
Isn’t perception what matters most?

Maybe: for mild/occasional insomnia, or for those treated non-pharmacologically

Maybe not: for chronic/severe cases (10% of adults)

- *When objective data is available in other settings, we do not use self-report (HTN, DM, obesity)*
- *Risks of medications (dependence, side effects)*
- *Uncertainty whether medicated sleep is “normal”*
- *20-50% of insomniacs have occult OSA*
Nearly every risk reportedly “associated” with short sleep duration is even worse with longer sleep durations.

Many potential confounding factors in epidemiology

Scant objective data

No evidence that modifying sleep duration is beneficial

(Kripke 2002)
Insomnia Treatment Options
Outpatient approach to insomnia

- Is there a treatable contributor?
  - apnea, depression, anxiety, pain, restless legs

- Insomnia phenotype informs treatment pathways:
  - Circadian delay (Rx: light, melatonin, sched)
  - Sleep Hygiene (Rx: education, sleep restrict)
  - Psychophysiologic (Rx: CBT-I versus meds)
  - Misperception (Rx: CBT-I, reassurance)
Sleep Hygiene

**DO:**
- Allow adequate time and environment for sleep
- Have “wind-down” time before bed
- Get out of bed at the same time each day
- Go to bed only when sleepy
- Keep a regular daily schedule (meals, exercise, etc)
- If not sleeping within 20 minutes, get out of bed**
  **caution: clockwatching & misperception!**

**DON’T:**
- Have caffeine, alcohol, or nicotine 4-6hrs before bed
- Take naps (but if you must, keep <3pm)
- Read or watch TV or check email etc in bed
- Go to bed hungry (but avoid heavy meals at night)
Issues re: hypnotic choice

- Little evidence for objective benefit, so individual risk-benefit discussions are challenging
- Choice may be influenced by:
  - Co-morbidities
    - Gabapentin: pain, RLS, headache
    - Tricyclics: pain, headache
    - Benzos/Z-drugs: parasomnia, complex apnea
  - Pharmacokinetics
    - Short acting (zolpidem, zaleplon)
    - Long acting (zolpidem CR, eszopiclone)
Insomnia treatment: Risk considerations

- Many sedating agents used off-label with little data
- Even approved drugs yield only 30-60 minutes extra
- No studies have shown medical benefit (though some data indicates mood improvement)
- Long-term use not recommended
- Dependence / Addiction
- Parasomnia (some can be dangerous)
- Drug-Drug interactions
- Hangover / Cognitive impact (*FDA: morning car risk)
- Falls
Insomnia treatment: CBT-I

- A specialized subset of CBT field
- Equivalent or superior to medications in clinical comparative effectiveness trials
- PhD therapists and online versions are available

**Cognitive Behavioral Therapy for Insomnia:**

- Stimulus control
- Sleep hygiene
- Sleep restriction
- Relaxation training
- Cognitive therapy (refocus beliefs)
Other Sleep Disorders
Narcolepsy (in one slide)

- Sleepiness + peri-sleep paraysis/hallucinations
- Half have cataplexy (triggered atonia attacks)
- Cataplexy is not on differential of syncope/seizure
- Testing: PSG + nap test (“MSLT”)
  - Rule out OSA and PLMS
  - Confirm fast sleep latencies and REM in >2 naps
  - Off psych meds/stimulants for >2 weeks prior
- Genetics and spinal fluid not routinely tested
- Rx: stimulants for sleepiness (modafinil, amphetam)
- Rx: anti-depressants for cataplexy
- Xyrem helps both sleepiness and cataplexy
Restless Legs (in one slide)

- Uncomfortable sensation (movement not required)
- Better with movement, massage, stretch
- Worse at night or “at rest” in day (car, plane, etc)
- Dx: history. PSG if refractory or OSA risk factors
- First Rx: oral iron if Ferritin <50
- Next Rx: pramipexole, ropinirole, gabapentin

- **Related:** Periodic limb movements of sleep (PLMS)
- Most RLS patients also have PLMS
- Most PLMS patients **do not** have RLS
- Need PSG for Dx
- Rx options same as RLS (shared pathophys)
Circadian Phase Delay (in one slide)

- Most common circadian problem
- Sleep is normal with late bed / late rise
- Shift schedule, if patient desires:
  - Melatonin 3 hrs before bedtime
  - Darkness while in bed
  - Light exposure at end of “night”
  - Shift sleep block by 30 minutes every other day
Parasomnia (in one slide)

- **NREM parasomnias** (walking, talking, eating, terror)
  
  Course: usually benign
  
  DDx includes seizure, REM behavior disorder
  
  Behavioral management (EtOH, caffeine, schedule)
  
  Treat occult sleep apnea or periodic limb movements

- **REM behavior disorder**: dream enactment
  
  Linked to Parkinson’s (may precede by decades)
  
  Other neurological disorders (concurrently)
  
  PSG confirms REM without atonia, rules out apnea
  
  Rx: Clonazepam, melatonin
  
  Bedroom safety, as injury is not uncommon
When all else fails and you can’t wake up...
Thank You!

www.mghsleep.com

mtbianchi@partners.org