Case Studies in Obstructive Sleep Apnea: Early Identification and Treatment

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Learning Objectives

- Recognize the symptoms of the drowsy patient (excessive sleepiness) and its causes
- Identify individuals who are at particular risk for obstructive sleep apnea (OSA).
- Compare effectiveness of polysomnography with that of other tools used to diagnose obstructive sleep apnea.
- Prescribe treatment, including behavioral therapy, pharmacologic agents, and continuous positive airway pressure (CPAP), for patients who have OSA.
- Support patients throughout treatment to ensure correction of underlying sleep deficits.
Patient Complaints of Excessive Sleepiness/Fatigue

“I’m tired all the time.”
“I have no energy.”
“I feel fatigued.”
“I feel depressed.”
“I don’t feel rested.”
“I don’t sleep well.”

Chervin RD. Sleepiness, fatigue, tiredness, and lack of energy in obstructive sleep apnea. Chest 2000;118:372-379;

What does it mean when a patient says he/she is “TIRED?”

- **Sleepiness**
  - Tendency to fall asleep or the inability to stay awake
  - Improved by sleep

- **Fatigue**
  - Sensation of weariness, tiredness, exhaustion, loss of energy; the desire to rest
  - Improved by rest

- **Lack of motivation**
  - “I don't feel like doing anything…”
Sleep-Wake Disorders: Prevalence Adult Population

- **OSA¹:** 3%-28%
- **Comorbid Insomnias⁶:** 6%
- **Narcolepsy⁵:** 0.06%†
- **SWSD²:** 8%-32%*
- **Insufficient Sleep Syndrome³:** 26%
- **RLS⁶:** 10%-15%

*Among night and rotating shift workers; †Prevalence of hypersomnias such as narcolepsy without cataplexy may be higher.

失眠障碍

- **Insufficient Sleep Syndrome³:** 8%-32%*
- **SWSD²:** 26%
- **Narcolepsy⁵:** 0.06%†

*Among night and rotating shift workers; †Prevalence of hypersomnias such as narcolepsy without cataplexy may be higher.

Sleepiness in America

US Adults Reporting That They Are So Sleepy It Interferes With Their Daily Activities

- 28% At least a few days per month
- 13% At least a few days per week

n=1000
ES is Prevalent Worldwide

- 17.7% in Norway had ESS>10
- 11.6% worldwide had ESS>10
  - Rates ranged from 6.2% (China) to 24.5% (South Africa)
  - 12.1% had at least 1 nighttime and 1 daytime symptom of moderate/severe impairment
- Total sleep durations were similar across countries (7.57±1.38 h)

Why Ask About Sleep?

Public health costs. . .

- 50,000 deaths per year
- More than $100 billion per year to preventable accidents

Excessive Sleepiness
Impaired Quality of Life

Age matched-control study of excessively sleepy adults (n=221)

Excessive Sleepiness in Residents
Night Call Schedule vs. Alcohol Ingestion

- Post-call performance impaired during a heavy call rotation = impairment associated with a 0.04 to 0.05 g% blood alcohol level
  - Driving speed 30% more variable with night call than alcohol
  - Reaction time, attention, lapses, omission errors, and crashes are similar between night call and alcohol

n=34 residents; Night call, average 80 hour-week with call every 4th or 5th night (34-36 hour work shift); alcohol, BAC 0.05-0.04% after light call (average 44 hour-week with night call only if on-call resident became ill).
Sleepiness of Obstructive Sleep Apnea and Driving

$15.9$ billion

1,400 deaths

800,000 accidents


OSA Defined

- Repetitive episodes of complete (apnea) or partial (hypopnea) upper airway obstruction during sleep¹
- Measured via Apnea/Hypopnea Index (AHI), the average number of apnea/hypopneas per hour
  - Apnea: cessation of airflow for at least 10 sec
  - Hypopnea: partial obstruction that is either severe enough, and/or causes desaturation, and/or arousal

Diagnostic criteria of OSA

1. Excessive sleepiness or related symptoms
   OR
2. Sleep interrupted by gasping/choking
   OR
3. Loud snoring
   AND
4. AHI > 5
   AND
5. Lack of better explanation for the disorder

Alternative Diagnostic criteria of OSA

1. AHI > 15
   AND
2. Lack of better explanation for the disorder
### Obstructive Sleep Apnea

#### Prevalence
- Approximately 18 million Americans experience OSA\(^1\)
- It is estimated that:
  - 1 in 5 adults has at least mild OSA\(^2\)
  - 1 in 15 adults has at least moderate OSA\(^2\)

Also:
- If criteria AHI > 5 and ES:
  - 2% women, 4% men
- If criteria AHI > 5 and NO ES:
  - 9% women, 24% men

- In 1997, it was estimated that up to 93% of women and 82% of men who have moderate to severe OSA remain clinically undiagnosed\(^{13}\)

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### Anatomy of OSA

<table>
<thead>
<tr>
<th>Normal Airway</th>
<th>OSA Airway</th>
</tr>
</thead>
</table>

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Consequences of OSA

- Sleep
  - Loss of Airway Tone
  - Airway Obstruction
    - Hypoxia
    - Hypercapnea
    - Acidosis
  - Arousal
  - Increase in airway tone
  - Patent airway

Cardiovascular Stressors
- Hypertension
- Chronic hypercapnea
- Pulmonary Hypertension
- Cor Pulmonale

Fragmented Sleep
- Hypersomnolence
- Impaired cognition


OSA Consequences: Morbidity

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.4-3.1</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>1.3-23</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>2.4</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.6</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Accidents</td>
<td>7</td>
</tr>
<tr>
<td>Industrial Accidents</td>
<td>2.2</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
</tr>
<tr>
<td>Motor Vehicle Accidents</td>
<td>7</td>
</tr>
<tr>
<td>Industrial Accidents</td>
<td>2.2</td>
</tr>
<tr>
<td>Diabetes and the metabolic syndrome</td>
<td></td>
</tr>
</tbody>
</table>

Consequences of OSA: Symptoms

- Excessive sleepiness (ES) is a major presenting complaint\(^1\)
  - Note different words used by patients (see below and above)\(^2\)
- Other symptoms include:\(^3\)
  - Loud habitual snoring
  - Nocturia/enuresis
  - Night sweats
  - Morning headache
  - Morning sore/dry throat
  - Trouble concentrating
  - Mood/behavior change
    - Irritability, depression
  - Gastroesophageal reflux


Obstructive Sleep Apnea: Risk of Psychiatric Disorders

Comorbid Psychiatric Diagnoses in a VA Database (N>4 million)

All disorders, \(P<0.0001\) vs. Non-OSA

PTSD, post-traumatic stress disorder; OSA, obstructive sleep apnea.
\(n=122,052\) with OSA diagnosis (estimated prevalence of OSA in database sample=2.97%)
Complaints Differ By Gender…

- Men
  - “I’m tired”
  - “My memory is bad”
  - “Lack of energy”
  - Less likely to say, “sleepy”: last choice

- Women:
  - “Sleepy”: first choice in women
  - “Insomnia”
  - More likely to have depression and hypothyroidism


Consequences of OSA: Bedpartner Complaints!

Partner’s Complaints

- Loud snoring
- Witnessed apnea
- Restless sleep
- Personality changes
## Epworth Sleepiness Scale (ESS)

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

<table>
<thead>
<tr>
<th>0 = Would never doze</th>
<th>2 = Moderate chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Slight chance of dozing</td>
<td>3 = High chance of dozing</td>
</tr>
</tbody>
</table>

### Situation | Chance of dozing (0–3)
---|---
Sitting and reading | 2
Watching television | 3
Sitting inactive in a public place, for example, a theater or meeting | 2
As a passenger in a car for an hour without break | 3
Lying down to rest in the afternoon | 3
Sitting and talking to someone | 3
Sitting quietly after lunch (when you’ve had no alcohol) | 3
In a car, while stopped in traffic | 3

**Your Total:**

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## Risk factors for OSA: demographics and social history

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Possible Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>Anatomy, vent control, stability</td>
</tr>
<tr>
<td>Male Sex</td>
<td>Anatomy, vent control</td>
</tr>
<tr>
<td>Aging</td>
<td>Anatomy, natural reflex impairment</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Impaired dilator muscle activity</td>
</tr>
<tr>
<td>Menopausal status</td>
<td>Unknown, possibly anatomy</td>
</tr>
<tr>
<td>Black Race</td>
<td>Unknown, possibly anatomy</td>
</tr>
<tr>
<td>Smoking</td>
<td>Airway inflammation, edema, or both</td>
</tr>
</tbody>
</table>

Adapted from Malhotra A. Lancet. 2002;360:237-245.
Risk factors for OSA: Physical Findings

- Large neck size
  - Men >17”, Women > 16”
- Micrognathia
- “Crowded” pharynx
- Nasal obstruction

Mallampati Scale

When To Suspect OSA

- Think of OSA at some point when patient comes in with
  - Co-morbid conditions as discussed above
  - Physical findings as described above
  - Symptoms as described above
- Screen for patients during complete physical exam
  - Look at family history
  - Ask:
    - “Do you feel sleepy during the day?”
    - “Do you snore?”

References:

When To Refer to Sleep Lab: Suggested Guidelines

Any of following during sleep:
- Gasping
- Choking
- Witnessed apneas

Or

Snoring + 1 or more of following:
- Insomnia
- ES
- BMI > 35
- Neck > 16/17
- Mallampati score: 3, 4
- Hypertension
Case Presentations
Applying the Evidence to Practice

Case Presentation #1
Seth W
Seth W

- 27 year-old white male
- Presents for physical exam because girlfriend thinks he “doesn’t look healthy”
- No complaints
- Past medical history: unremarkable
- Social history:
  - Landscaper by day, guitar player in band on weekends
  - Few beers per day, no smoking, no drugs
- Family history: father with HTN and depression
- No meds

Further on Seth:

- Review of symptoms:
  - Admits to occasional tiredness, but says it’s from working hard.
  - Does fall asleep easily while watching TV
    - In the past few years, he has never seen the ending of a movie.
  - Girlfriend complains he snores badly
Further on Seth:

- **Physical Exam:**
  - BMI = 30
  - 140/80
  - Mallampati = 3
  - Neck: 16”

- **Epworth Sleepiness Score = 14**

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**Clinical Practice Recommendation**

**Practice Recommendation**
Use a sleep questionnaire (e.g., Epworth Sleepiness Scale) to screen for sleep abnormalities (Elliott, 2001)

**Evidence-Based Source**
Screening for obstructive sleep apnea in the primary care setting. University of Texas, School of Nursing, Family Nurse Practitioner Program. Screening for obstructive sleep apnea in the primary care setting. Austin (TX): University of Texas, School of Nursing; May 2006.

**Website of Supporting Evidence**

**Strength of Evidence**
Strength of Recommendation: A
Quality of Evidence: Good
Question

- Which of the following are NOT Seth’s risk factors for OSA?
  1. Elevated Blood Pressure
  2. Obesity
  3. Crowded pharynx
  4. Neck size ≥ 16”

Question – Correct Answer

- Which of the following are NOT Seth’s risk factors for OSA?
  1. Elevated Blood Pressure
  2. Obesity
  3. Crowded pharynx
  4. Neck size ≥ 16”
OSA is strongly suspected:

- Seth’s risk factors for OSA:
  - Elevated BP
  - Obesity
  - Crowded pharynx

- His symptoms that suggest OSA:
  - Snore
  - Sleepy

**Question**

- What are your next steps?
  1. Educate Seth about OSA
  2. Refer for sleep consultation or sleep study
  3. Order appropriate lab tests
  4. Begin conservative approach until diagnosis is confirmed
  5. All of the above
Question – Correct Answer

- What are your next steps?
  
1. Educate Seth about OSA
2. Refer for sleep consultation or sleep study
3. Order appropriate lab tests
4. Begin conservative approach until diagnosis is confirmed
5. All of the above

Treating OSA: Conservative Approaches

- Avoidance of CNS depressants
- Reduced alcohol consumption, especially before bedtime
- Lateral body position during sleep (versus supine)
- Good sleep hygiene
- Consider weight loss program (10% weight loss is associated with a 26% decrease in AHI)

Clinical Practice Recommendation

Practice Recommendation
Use nocturnal polysomnographic (NPSG) diagnostic testing to diagnose OSA.

Evidence-based Source
University of Texas, School of Nursing, Family Nurse Practitioner Program.
Screening for obstructive sleep apnea in the primary care setting. Austin (TX):
University of Texas, School of Nursing; May 2006.

Website of Supporting Evidence

Strength of Evidence
Strength of Recommendation: A
Quality of Evidence: Good

Principles of Good Sleep Hygiene

- Spend 7 to 8 hours in bed
- Maintain regular sleep/wake schedule
- Discontinue caffeine 4 to 6 hours before bedtime, and minimize total daily use
- Avoid nicotine, especially near bedtime and upon night awakenings
- Get regular exercise
- Minimize noise, light and excessive temperatures during the sleep period

National Heart, Lung, and Blood Institute Working Group on Insomnia. 1998
Seth 2 Weeks Later

- 2 weeks later you make a diagnosis of OSA based on results of sleep study
  - 1st 4 hours AHI = 44, desaturated down to 83%
  - Split study done, titrated with CPAP at 9 cm, eliminating all apneas and normalizing pulse oxymetry
  - Patient was seen that morning by respiratory therapist, and fitted with his choice of nasal mask
  - CPAP with “smart card” to monitor usage
  - Patient reports usage daily

- All labs normal
- Follow up in 2 weeks, and also with sleep lab as advised

OSA and CPAP

OSA Airway | CPAP-Treated Airway

CPAP = continuous positive airway pressure.
Seth at 1 month

- Patient returns in another 2 weeks, still doing well.
- Sleepiness appreciably reduced
  - No longer falls asleep during movies
- No longer snoring
- Epworth Sleepiness Score = 9
- Patient is advised to follow up with sleep lab every 6 months per their requirements, and to return if any problems

Case Presentation #2

Soji X
Soji X

- 45 year-old Native American woman presents with chief complaint of weight gain
- History of Present Illness: 61” tall, 175 lb, has gained 15 lbs since her last visit 1 year ago. Eating same, not exercising as usual (no time, no energy). Admits to less interest and enjoyment than usual, less motivated, compatible with moderate depression.
- Past medical history: depression, had been on valproate (Depakote) and citalopram (Celexa) in past, recently restarted by psychiatrist
- Social history: Works full time college Spanish teacher, one child in day care, one husband at home. No alcohol or tobacco.
- Family history: unknown

Soji X

- Physical exam:
  - Looks tired, frustrated
  - BMI = 33
  - Neck size looks large, measures 16.5”
  - Mallampati = 4
  - Epworth Sleepiness Score = 16
- Further questioning:
  - She thinks she may snore, but husband hasn’t remarked lately
  - Does get drowsy in meetings and while students are taking test, but never falls asleep
  - Has trouble falling asleep at night, wakes up often for no reason, but goes to bathroom anyway.
  - More headaches lately, especially when she first wakes up; also, migraines are back.
Question

Which of the following should NOT be included in the differential diagnosis for Soji’s tiredness and weight gain?

1. Depression
2. Iron deficiency, with or without anemia
3. Migraine
4. Hypothyroid
5. OSA
6. None of the above

Question – Correct Answer

Which of the following should NOT be included in the differential diagnosis for Soji’s tiredness and weight gain?

1. Depression
2. Iron deficiency, with or without anemia
3. Migraine
4. Hypothyroid
5. OSA
6. **None of the above**
**Question**

- What is best to do at this time?
  1. Give her a sleep medication.
  2. Give her weight loss medication.
  3. Order labs, ask her to keep sleep diary, discuss sleep hygiene, return in 2 weeks with her husband.
  4. Give her activating medication like bupropion and ask her to call your office in a few weeks.

**Question – Correct Answer**

- What is best to do at this time?
  1. Give her a sleep medication.
  2. Give her weight loss medication.
  3. **Order labs, ask her to keep sleep diary, discuss sleep hygiene, return in 2 weeks with her husband**
  4. Give her activating medication like bupropion and ask her to call your office in a few weeks.
**Soji 2 weeks later**

- Patient returns in few weeks with her husband, who confirms loud snoring, and gasping at times
- Sleep diary indicates 5-6 hours of sleep per night, no naps, tired throughout the day
- Labs normal
- Psychiatrist has switched her from citalopram to bupropion
- She says she feels the same, if not worse.
- You refer for sleep testing

**In another 2 weeks...**

- Sleep study confirms OSA with AHI of 51
- Soji has been fitted for CPAP and titrated to 7.5 cm
- She hates it:
  - “Constricting, confining, claustrophobic, not sexy.”
  - Pulls it off all night, awakening husband, who asks her to put it back on.
- She feels no better. She wants a diet pill.
Question

- Which of the following options for this patient would NOT be a good idea?
  1. Change the mask, encourage perseverance
  2. Oral appliance
  3. ENT consultation for possible surgery
  4. Weight loss pill

Question – Correct Answer

- Which of the following options for this patient would NOT be a good idea?
  1. Change the mask, encourage perseverance
  2. Oral appliance
  3. ENT consultation for possible surgery
  4. Weight loss pill
CPAP Can Improve:

- Quality of life
- Cardiovascular disease
- Cognitive function
- Mood


Clinical Practice Recommendation

Practice Recommendation
Next to tracheostomy, positive pressure is the most efficacious treatment for obstructive sleep apnea/hypopnea syndrome (OSAHS).

Evidence-based Source

Website of Supporting Evidence

Strength of Evidence
Strength of Recommendation: A
Quality of Evidence: Good
But Not All Patients Like It

- Patients’ compliance CPAP is variable:
  - ranges from 65 percent to 80 percent

- Noncompliance may be the biggest barrier to effective use of CPAP. Some patients experience:
  - Sneezing, nasal discharge, and dryness;
  - Facial abrasions from an ill-fitting mask;
  - Claustrophobia and/or panic attacks;
  - Discomfort from pressure on exhalation

How To Increase CPAP Compliance: Follow-up!

- Ask the patient to articulate discomfort¹
- Let the patient select the mask¹
- Adjust CPAP pressure
- Add heated humidification
- Treat any nasal obstruction
- Have patient watch video of OSA
- Monitor compliance within the first few days²

OSA: Alternative treatments

- Dental (oral) appliance
- Airway surgery (Uvulopalatopharyngoplasty [UPPP], hyoid advancement)
- Positioning
- Weight loss

Soji: 1 month follow up

- Patient is fitted with pillow mask
- She feels much better, and is less drowsy
- Her ESS = 10
- You ask her to return every 3 months to ensure compliance and continued good response
- She is advised to follow up with sleep specialist as advised
Case Presentation #3

Richard R

- 39-year-old white male comes in for first office visit with you. No complaints.
- Past medical history:
  - OSA diagnosed 2 years prior
  - Mildly overweight
  - Borderline hypertension, “being watched”
  - No meds
- Social history:
  - few drinks during business trips/dinners
  - quit smoking few years ago, restarted lately
  - Wife, 3 kids, full-time VP of sales in national chain
- Family history:
  - Father died in 50’s of MI
Richard R

- Upon further questioning:
  - Compliant with CPAP, uses 6-7 hours a night, usually takes with him on trips
  - Last sleep test was 1 ½ years ago, and was okay
  - More drowsy lately, though—tried hard to stay awake while driving home after work

- Physical exam:
  - 130/80
  - BMI = 29
  - Mallampatti = 2
  - Neck size 15.5
  - ESS = 14

- Old records: normal labs 3 months prior

Question

- Which of the following measures are appropriate for his continued sleepiness?
  1. Ensure he is using the CPAP properly
  2. Refer back to sleep lab/specialist
  3. Review proper sleep hygiene measures
  4. Look for other causes of ES
  5. All of the above
Question – Correct Answer

- Which of the following measures are appropriate for his continued sleepiness?

1. Ensure he is using the CPAP properly
2. Refer back to sleep lab/specialist
3. Review proper sleep hygiene measures
4. Look for other causes of ES
5. All of the above

Richard returns in 2 weeks…

- Wife stated that his mask was leaking, so he did get a new mask
- Has been more attentive to better sleep habits
- Has lessened smoking and alcohol
- Still sleepy though
- Referred to sleep lab for repeat test
OSA: Residual Sleepiness and Functional Impairment With CPAP*

After 3 Months of CPAP Treatment*

Average CPAP use over 3 months was 4.7 hours per night, which is consistent with other studies of CPAP adherence. Data presented as mean. Mean baseline AHI was 64 per hour. CPAP treatment was consistent with standard clinical practice.


Residual Excessive Sleepiness in Obstructive Sleep Apnea Syndrome

Causes

- Inadequate total sleep time
- Inadequate CPAP pressure/Sleep disruption from CPAP device
- Coexistent illnesses or medications
  - RLS/PLMD
  - Narcolepsy
  - Psychiatric/other disorder
- Hypoxic brain injury in severe obstructive sleep apnea
- Inherent “side effect” of the CPAP mask?

**What Are Your Next Steps?**

A. Optimize CPAP therapy  
   - Check mask fit/type  
   - Adjust pressure  
   - Adjust humidity  
   - Treat rhinitis/sinusitis and nasal obstruction

B. Optimize sleep hygiene

C. Trial of medication

D. Suggest he cut back his hours at work to get more rest.

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**Use of Medication to Treat Residual Excessive Sleepiness in OSA**

Modafinil (Provigil)

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only medication indicated for this purpose</td>
<td>Schedule IV</td>
</tr>
<tr>
<td>Once a day, half life of 15 hours</td>
<td>Headache, anxiety, nausea</td>
</tr>
<tr>
<td>Low risk of habituation</td>
<td>Usually requires prior authorization</td>
</tr>
<tr>
<td>Improves daytime function</td>
<td>Some rare but severe allergic reactions</td>
</tr>
</tbody>
</table>

Richard at Follow-Up

- The patient begins modafinil 200 mg in AM. Calls in 1 week improved, tolerating the medication well.
- He returns in 2 weeks still improved, but not as well as he would like; ESS = 11
- Dosage increased to 400 mg in AM
- He returns in another month feeling fine, no noticeable sleepiness; ESS = 9

Summary Challenge

- Screen for sleepiness when patient has risk factors for it and/or has symptoms suggestive of sleepiness
- Administer the Epworth Sleepiness Scale (ESS)—a tool that’s easy to use and takes < 5 minutes whenever a patient mentions that:
  - he or she feels tired during the day,
  - his or her head hurts upon waking, or
  - he or she sweats during the night,
- Ask whether the patient’s partner has noticed snoring or periods when the patient appears to stop breathing and startle him- or herself awake.
- Refer patients for appropriate testing (either home or sleep lab) expeditiously
- Follow-up!
Thank You!