OSA: Where Are We and Where are We Going?

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Obstructive Sleep Apnea

- Sleep disordered breathing characterized by narrowing of the airway impairing normal ventilation during sleep
- Prevalence of OSA
  - 26% of adults between 30-70 years old
  - Primarily increasing due to the obesity epidemic
  - Much higher rates observed in bariatric surgery and stroke patients (60-80%)
Characteristics of the OSA patient

- Obesity (BMI≥30) is an independent predictor of at least mild OSA, as compared to being of normal weight or overweight
  - A 10% increase in body weight predicted a 30% worsening of AHI, whereas a 10% decrease in body weight predicts a 25% improvement in AHI
  - If already obese, the 10% increase in weight was equivalent to a 6-fold increase in the odds of having moderate to severe OSA (AHI≥15)
- Additional features more in OSA patients as compared to the general public include large tongue and tonsils, longer soft palate, shallow airway seen with micrognathia/retroganathia, large neck circumference (>17” in males)
- Comorbid diseases that herald increased rates of OSA
  - CAD, CHF, heart arrhythmias, refractory HTN, Type 2 DM, and PCOS
Consequences of Untreated OSA

- Likely related to fragmented sleep, cyclic hypercapnia/hypoxia, intrathoracic pressure swings, and increased sympathetic activity with frequent apneas
- Quality of Life issues – decreased concentration, excessive daytime sleepiness, fatigue, and poor quality sleep (insomnia), job-related and motor vehicle accidents, relationship discord (separate bed phenomenon)
- Medical issues – Cardiovascular disease, CHF, arrhythmias, stroke, glucose intolerance, HTN, Depression/anxiety, GERD, Nocturia, Impotence, sudden death (although this is likely a product of the above)
Screening measures include signs and symptoms, as well as subjective patient questionnaires (e.g. STOP-BANG, Epworth, etc.)

- Personally, I use Epworth and scores ≥10 are indicative of excessive daytime sleepiness (EDS)
- Inconsistent studies on which screen is superior
- No correlation between screening scores and severity of OSA

Symptoms that are approved for evaluation for OSA – non-restorative sleep (insomnia), fatigue, EDS (screened or reported), witnessed gasping/apneas/choking, snoring, depression, uncontrolled HTN, stroke, CHF, cognitive dysfunction, new onset Afib

- I typically like to use 3 indications – most typically snoring, non-restorative sleep, and EDS.
All right, my patient probably has OSA, what next?
Ordering the PSG

- When ordering the PSG, please try to include indications for the testing as they will be placed in the report to be consistent with the complaints you are receiving from the patient and what is being reported on.
- The sleep lab provides the patient an extensive questionnaire that asks about these features to better understand their complaints prior to analyzing the sleep study.
From a technique standpoint in the lab, there is really no difference between ordering the Routine PSG and the Split PSG in EPIC.

- Caveat: If your patient has previously had a diagnosis of OSA, and “lost” their CPAP, feel free to order the Split and in the comments note that fact, so that the patient can be aggressively managed (usually AHI>20) in lab to establish therapy, that they will probably need.

Indications for Split night therapy

- Moderate to severe OSA after 2 hours of diagnostic PSG (AHI≥30)
- At least 3 hours available for CPAP titration
- Techs are monitoring for these indications and these are not predictable prior to starting the testing – thus no difference between the routine and split studies
Interpreting the PSG

- The overnight techs are scoring obvious events on the fly to make sure we are efficiently managing the patients – looking for the indication for a split night study.
- The daytime scoring tech then evaluates the whole study looking for sleep-related breathing disorders, sleep-related movement disorders, and parasomnias. Scoring includes hypopneas, obstructive apneas, central apneas, and limb movements.
  - Hypopneas – 30% decrease in flow with 4% desaturation of SaO2
  - Apneas – 90% decrease in flow >10 seconds in length
Interpreting the PSG

- Finally, I review the study in its entirety including EKG, limb movements, breathing events, and EEG sleep patterns and establish the diagnosis.
  - Obstructive AHI ≥ 5 with 3 signs/symptoms or AHI ≥ 15 without symptoms (rare to end up in lab without symptoms) = OSA
- Severity
  - AHI ≥ 5, but < 15 = Mild
  - AHI ≥ 15, but < 30 = Moderate
  - AHI ≥ 30 = Severe
Interpreting the PSG

Other findings

- Periodic limb movement index > 15 = Periodic limb movements of sleep
  - 70% correlation between elevated PLMs and clinical Restless Legs Syndrome
- Central apneas with central AI ≥ 5 = Central apnea
  - However, Central apneas must be greater than half of all AHI to be diagnostic
  - Usually not seen until PAP therapy has been started
- Sleep-related hypoxia/hypoxemia – SaO2 (without obstructions) ≤88% for ≥5 minutes of total sleep time
- More rare findings
  - Bruxism (teeth grinding)
  - REM behavior disorder – seen usually in patients who have been diagnosed with Parkinson’s Disease
All right, my patient definitely has OSA, what next?
PAP Therapy

- PAP therapy is the gold standard for treatment of OSA
- Continuous Positive Airway Pressure (CPAP)
  - 1 pressure value patients are breathing in and out against
  - “The Reverse Vacuum”
  - Acts as an air “stent”
  - Indicated for all varieties of OSA
  - Disadvantage is the patient who has significant variance in his positional needs
Auto CPAP

- Auto CPAP is CPAP with a variable pressure head
  - Min Pressure 4 cm of H2O (CWP), Max Pressure 20 CWP
- Advantages
  - Good for at home trials for those who cannot tolerate the sleep lab
  - Good for patients who have varied needs based on sleeping position
  - Can provide data following inadequate lab titrations seen sometimes in the split night setting
- Disadvantages
  - Does not change on a breath by breath basis – adjusts over 5 minute windows typically or with 3 minutes of constant snoring
  - Patients have to have quick follow-up and tailoring of the settings to ensure compliance and benefit if done as a therapy trial
Bilevel Positive Airway Pressure (BPAP)

- Two levels of pressure – IPAP (inspiratory)/EPAP (expiratory)
  - Min pressure 4 CWP, Max pressure 25 CWP, Min pressure support (PS) 2, Max PS 8-10 (depending on machine)
- Improves patient comfort especially for those with many residual hypopneas without apneas
  - EPAP adjustments are for apneas
  - IPAP adjustments are for hypopneas
Bilevel Positive Airway Pressure (BPAP)

- **Advantages**
  - Patient comfort – no longer breathing out against a hurricane
  - Typically improves mask leak
  - Pressure support and high max pressures allow for improved therapy if CPAP maxed out

- **Disadvantages**
  - Requires in-lab titration with a lot of moving parts for the overnight techs to interpret
  - Worsens central apnea
  - Must have failed CPAP in some way – usually pressure intolerance vs. residual AHI on follow-up visit
Auto BPAP

- BPAP with variable pressure heads
- Typically setup with variable EPAP with max and min PS, and IPAP Max

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Other Non-Invasive Ventilation

- **Adaptive Servo Ventilator (ASV)**
  - Used for central sleep apnea with Cheyne-Stokes Breathing
  - Serve-HF trial showed detriment in patients with severe heart failure and thus has fallen somewhat out of favor
  - If predominant OSA with central-type events, it is still being used

- **Average Volume Assured Pressure Support (AVAPS)**
  - Used for persistent hypoventilators as seen with neuromuscular disease, obesity hypoventilation, and severe COPD with well treated OSA and persistent hypercarbia/hypoxemia
  - Similar to BPAP with backup rate
Other therapies

- **Conservative Measures**
  - Positional therapy – studies have shown no consistent long term benefit to positional therapy in terms of correcting OSA
    - Tennis ball T-shirt or other higher priced entities
  - Weight loss – As mentioned earlier, improves AHI but rare to “cure” OSA
  - Avoidance of respiratory depressants (anxiolytics, EtOH) – benefits AHI and likely sleep maintenance insomnia, but again not curative
Other therapies

- **Surgical**
  - **Tonsillectomy** – remains the treatment of choice in pediatrics <12, assuming evidence of tonsillomegaly or tight oropharynx
    - No similar benefit in adults or teenagers
  - **Uvulopalatopharyngoplasty**
    - Success rates vary between 10-30% in terms of improving sleep apnea
    - Excellent for primary snoring as often the excess tissue is the cause of the snoring
    - Can be beneficial if the obstruction is at the palate level
    - The highly variable levels of obstruction from tongue to windpipe have this being done far less
Other therapies

- **Oral Appliance Therapy (OAT), Mandibular Advancement Device (MAD)**
  - Pulls the mandible forward to open the airway
  - **DO NOT JUST BUY ONLINE**
  - Should be fitted by a dental professional and be titratable
  - Requires preceding and following PSG to prove benefit
  - Only for mild to moderate apnea
PAP therapy
- Air Leaks
- Skin Irritation
- Claustrophobia
- Tangled in the hose
- Too Loud
- Aerophagia (bloating)
- Dry Mouth
- Pressure intolerance

Surgical
- Recurrent snoring/reflux through the nose – due to velopharyngeal insufficiency
- No improvement

OAT/MAD
- Jaw pain/TMJ
- Tooth pain
My patients are unable to tolerate their therapy, now what?
Follow-up

- Most of the PAP follow-ups, I have asked to see me to show benefit and compliance and meet their insurance standards
  - If you want to see your own patients, that is no problem, just let me know
- At that follow-up, we discuss the therapy as well as try to come up with fixes for any PAP related complaints
  - Can include different interface (>200 masks both nasal and full face to choose from), better comfort measures (Nasal cushions, strap cushions, humidity), or undertreatment requiring additional pressure
Follow-up

- Additionally, we often discuss other alternatives to PAP therapy as some people just plain do not like it.
- Anecdotally, CPAP compliance is higher in patients with severe OSA (likely due to perceived benefit), who have had alternatives discussed with them (both pro and cons) and who have an understanding of the resultant diseases due to untreated sleep apnea. Additionally, if the bed partner feels things are going better, then that also improves compliance.
What about the future of sleep medicine?
Insurance companies have been moving to promote HSAT as an alternative to PSG due to cost cutting measures.

Patients often like this idea due to being able to sleep at home and not travel to centers for PSG.

Qualifying patients must have a high PPV of OSA (signs and symptoms of OSA with + screen) WITHOUT certain comorbidities:
- Exclusions: Cardiopulmonary disease, neuromuscular weakness, chronic opiate use, symptoms of additional sleep disorders (RBD, PLMs).

There is currently a division in the best way to start HSATs at most centers:
- Purchase equipment (VAs) and train patients to use it appropriately for their study – increases technical adequacy – inefficient, with increased upfront costs.
- Hire it out to DME/HSAT companies who provide patients with instruction (written, video) and are responsible for the equipment – significant variability in technical adequacy, but increased efficiency for providers (single form) with no equipment to manage and update.
Home Sleep Apnea Testing (HSAT)

**The Devil in the Details**
- HSAT equipment costs are variable to purchase, and usually multiplied for consumables (nasal cannula, batteries) or repairs, not to mention possible non-return by patients
- Some patients don’t have the necessary ability or technical acumen to understand the setup at home
- The “best” HSAT equipment data does not exist
- If you shop it to a DME/HSAT provider, your studies are not interpreted (usually) by the local sleep physician who would read the in-lab
- Should a study not be technically adequate or inconclusive (early results show this is more often the case due to patient technical issues), the patient will then be sent for an in-lab PSG, not adding to the cost for this work-up that insurance companies were trying to cut

**Some HSAT/DME companies are now allowing the local providers to interpret their own HSATs**
Cranial Nerve Stimulation

• **Hypoglossal Nerve Stimulator**
  - Targets muscle tone of the throat to open the airway during sleep
  - Done by ENT trained in the implantation and titration of the device – University of Iowa and Mayo both doing it
  - 3 patients currently implanted in Iowa
  - Developed with Dr. Soose, an ENT at University of Pittsburgh
Cranial Nerve Stimulation

- **Indications**
  - Age > 22 years
  - Moderate to severe OSA (AHI 20-65)
  - Unable to use CPAP
  - ENT evaluation does not show complete concentric collapse at the palate
  - BMI <32

- **PAP Failure**
  - AHI>20 despite CPAP
  - PAP Intolerance
    - <5 nights of use per week
    - <4 hours per night of use
    - Unwillingness to use it
Thank you for your attention!

QUESTIONS?