UPDATES IN SLEEP APNEA:
CPAP, CPAP COMPLIANCE, & ALTERNATIVES

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DISCLOSURE

I have no conflicts that pertain to this lecture.
OBJECTIVES

• Understanding diagnosis and diagnostic testing for obstructive sleep apnea.
• Endpoints for treatment of obstructive sleep apnea
• Patient engagement in treatment of apnea
• Noncompliant patients and treatment of sleep apnea
• Newer treatment options
SLEEP APNEA

- The repetitive cessation of breathing noted during sleep.
  - Obstructive
  - Central
  - Mixed
  - Periodic breathing

- Abnormal is AH1 (apnea-hypopnea index) > 5 in patient with symptoms and > 15 in patient without symptoms
Normal breathing
During sleep, air can travel freely to and from your lungs through your airways.

Obstructive Sleep Apnoea
Your airway collapses, stopping air from traveling freely to and from your lungs and disturbing your sleep.
The Cycle that Kills

- Resume Sleep
- Decreased UA Muscle Tone
- Obstructive Apnea/Hypopnea
- Relieve Hypoxia & Reduced CO2
- Hypoxia & Elevated CO2
- Relief of Obstruction
- Increased Ventilatory Effort
- Arousal

Sleep Onset
OBSTRUCTIVE SLEEP APNEA

Symptoms of Sleep Apnea

- Interrupting of breathing during sleep
- Falling asleep during the day
- Restless sleep
- Loud snoring
- Irritability
- Forgetfulness
- Anxiety
- Depression
- Morning headaches
- Mood or behavior changes
DIAGNOSTIC TESTING

Home sleep testing

In lab sleep testing

• HOME TESTING is reserved for patients with high pretest probability of having obstructive sleep apnea

• IN LAB TESTING required for high risk populations including those with stroke, congestive heart failure, advanced lung disease, pediatric population and those with intellectual disabilities.
WHICH TEST WOULD BE MOST APPROPRIATE TEST FOR EVALUATING A 47 YEAR OLD MALE PATIENT WHO HAS ATRIAL FIBRILLATION, SNORES AND HAS A BMI OF 32.1 KG/M². HE WAS RECENTLY HOSPITALIZED FOR SUSPECTED MYOCARDIAL INFARCTION AND WHILE HE WAS IN THE HOSPITAL HE HAD PERIODS OF BREATHING WITH WITNESSED PAUSES.

A. In lab testing single night.
B. Home testing single night.
C. Home testing multiple nights.
D. In lab testing multiple nights.
### Risk indicator

#### Normal range

#### Suspected pathological breathing disorder

<table>
<thead>
<tr>
<th>Index</th>
<th>Normal</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHI</td>
<td>56</td>
<td>&lt; 5/ h</td>
</tr>
<tr>
<td>Apnea index</td>
<td>24</td>
<td>&lt; 5/ h</td>
</tr>
<tr>
<td>Hypognea index</td>
<td>100</td>
<td>&lt; 5/ h</td>
</tr>
<tr>
<td>% Flow lm. Br. without Sn (FL)</td>
<td>11</td>
<td>&lt; approx. 50</td>
</tr>
<tr>
<td>% Flow lm. Br. with Sn (FS)</td>
<td>6</td>
<td>&lt; approx. 40</td>
</tr>
<tr>
<td>CGI Oxygen Desaturation Index</td>
<td>55</td>
<td>&lt; 5/ h</td>
</tr>
<tr>
<td>Average saturation</td>
<td>96</td>
<td>94% - 98%</td>
</tr>
<tr>
<td>Lowest desaturation</td>
<td>71</td>
<td>70%</td>
</tr>
<tr>
<td>Baseline Saturation</td>
<td>97</td>
<td>97%</td>
</tr>
<tr>
<td>Minimum pulse frequency</td>
<td>40</td>
<td>50 - 70 kpm</td>
</tr>
<tr>
<td>Maximum pulse frequency</td>
<td>73</td>
<td>69 - 99 kpm</td>
</tr>
<tr>
<td>Average pulse frequency</td>
<td>60</td>
<td>60 kpm</td>
</tr>
</tbody>
</table>

**Proportion of probable C8 epochs:**
- 54%

**Analysis status:** Analyzed automatically

**Analysis parameters used (Default):**
- AHI 10%
- Apnea 50%
- Hypognea 70%
- Oxygen 70%
- Minimum pulse frequency 50%
- Maximum pulse frequency 70%

**Comments**
CASE: MARK

• 62yo Caucasian male BMI 25.6 and neck 17 inches. History of snoring, seasonal allergies and trouble staying asleep. He was diagnosed with mild sleep apnea approximately 5 years ago. Sent in today by hematologist for excessive daytime sleepiness.

• Treatment history, started CPAP and “didn’t like it.” Lost 20 pounds through diet and exercise and felt his sleep apnea went away because he stopped snoring. Never returned to sleep clinic and his doctor told him he could stop CPAP. He has been seeing hematologist for phlebotomy monthly for polythycemia.
STUDY OVERVIEW: The study was performed on 08/27/2018. The recording was started at 9:36 PM and ended at 3:55 AM for a total recording duration of 6 hours and 19 minutes. The overall evaluation duration was 5 hours and 58 minutes.

RESPIRATORY EVENT SUMMARY: The patient had 1 apneas, there are 0 obstructive, 0 (0%) unclassified, 1 central and 0 mixed apneas; and 33 hypopneas for a combined apnea-hypopnea index (AHI) of 5.7 respiratory events per hour. There were 1559 snoring events recorded.

OXYGENATION: The patient’s average oxygen saturation was 93%, and the lowest saturation was 83%. There were 53 min (14%) minutes below 90% saturation. There were 0 min (0%) minutes below 88% saturation.

PULSE RATE: The patient had a minimum heart rate of 48 beats/minute, a maximum heart rate of 78 beats/minute; and an average heart rate of 58 beats/minute.

OVERALL IMPRESSION: This is an abnormal study with mild obstructive sleep apnea.
TREATMENT OF SLEEP APNEA
BEHAVIORAL TREATMENTS:

• Avoidance of sedatives prior to bedtime (including alcohol)
• Avoidance of supine sleep when possible
• Treatment of snoring and nasal congestion
• Removal of actual obstruction
• Weight loss
NASAL END EXPIRATORY VALVES

A Novel Nasal Expiratory Positive Airway Pressure (EPAP) Device for the Treatment of Obstructive Sleep Apnea: A Randomized Controlled Trial Berry, RB, Kryger, MH, Massie, CA [SLEEP 2011;34 (4):479-485] (19 Center, 3 Month, Randomized Controlled Trial)

www.proventtherapy.com
ORAL PRESSURE THERAPY

Oral Pressure Therapy OPT

- Light Oral Vacuum
- Soft, Flexible Mouthpiece

Getsleepsmart.com/winx
Oral Appliances for Snoring and Obstructive Sleep Apnea: A Review

Kathleen A. Ferguson, MD; Rosalind Cartwright, PhD; Robert Rogers, DMD; Wolfgang Schmidt-Nowara, MD

1Division of Respirology, University of Western Ontario, London, Ontario, Canada, 2Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL, 3Department of Dental Medicine, St. Barnabas Medical Center, Gibsonia, PA, 4University of Texas Southwestern, Sleep Medicine Associates of Texas, Dallas, TX

www.ihatecpap.com
“...health outcomes in patients with moderate to severe OSA were similar after treatment...likely explained by the greater efficacy of CPAP being offset by inferior compliance...” (Am J Respir Crit Care Med 2013; V187:8, 879–887).
CPAP/BIPAP

CPAP Therapy
A potential life saving and changing option for the treatment of sleep apnea.
CONTINUOUS POSITIVE AIRWAY PRESSURE

• The first CPAP was used in 1981
• Mechanism: pneumatic split on the airway to prevent apnea
• Initial CPAP was nonresponsive and nonreactive
• CPAP – auto
  • Responsive to variations in breathing and able to react to resistance
  • Different algorithms developed for difference manufacturers
• BIPAP
  • Ability for the inhalation pressure to be different from exhalation
• Travel machines and Cleaning machines improve patient compliance
CPAP AND PATIENT INTERACTIVE

• Patient compliance monitoring

• Interactive application platforms
  • Dreammapper/Sleepmapper
  • MYAIRVIEW
  • Improvement in patient satisfaction independent of patient age
## Therapy Event Summary

### Compliance Summary
- Days with Device Usage: 26 days
- Percentage of Days >=4 Hours: 83.3%
- Average Usage (Days Used): 7 hrs. 50 mins. 16 secs.
- Average Usage (All Days): 6 hrs. 47 mins. 34 secs.

### Apnea Indices
- Average AH1: 1.5
- Average OA Index: 0.3
- Average CA Index: 0.1

### Ventilator Statistics
- Average Breath Rate: 19.9 bpm
- Average % Patient Triggered Breaths: N/A
- Average Tidal Volume: 433.0 ml
- Average Minute Vent: N/A

### Large Leak
- Average Time in Large Leak: 5 mins. 32 secs.
- Average % of Night in Large Leak: 1.2%

### Periodic Breathing
- Average % of Night in PB: 0.6%

## Therapy Data Reporting

<table>
<thead>
<tr>
<th>Date</th>
<th>Time Start</th>
<th>Time End</th>
<th>AH1</th>
<th>OA Index</th>
<th>CA Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/13/2018</td>
<td>6:03:02</td>
<td>2:44:18</td>
<td>1.62</td>
<td>1.47</td>
<td>2:44:18</td>
</tr>
<tr>
<td>7/12/2018</td>
<td>8:00:54</td>
<td>2:14:53</td>
<td>1.62</td>
<td>1.47</td>
<td>2:14:53</td>
</tr>
<tr>
<td>7/11/2018</td>
<td>6:00:54</td>
<td>2:14:53</td>
<td>1.62</td>
<td>1.47</td>
<td>2:14:53</td>
</tr>
<tr>
<td>7/10/2018</td>
<td>6:00:54</td>
<td>2:14:53</td>
<td>1.62</td>
<td>1.47</td>
<td>2:14:53</td>
</tr>
<tr>
<td>7/7/2018</td>
<td>6:07:59</td>
<td>2:30:10</td>
<td>1.62</td>
<td>1.47</td>
<td>2:30:10</td>
</tr>
<tr>
<td>7/6/2018</td>
<td>6:04:12</td>
<td>2:06:10</td>
<td>1.62</td>
<td>1.47</td>
<td>2:06:10</td>
</tr>
<tr>
<td>Metric</td>
<td>Value</td>
<td></td>
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<td>--------------------------------</td>
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<td></td>
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<tr>
<td>Average usage (days used)</td>
<td>4 hours 46 minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median usage (days used)</td>
<td>4 hours 43 minutes</td>
<td></td>
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<tr>
<td>Total used hours (value since last reset - 09/06/2018)</td>
<td>85 hours</td>
<td></td>
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</tr>
<tr>
<td><strong>AirCurve 10 VAuto</strong></td>
<td></td>
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</tr>
<tr>
<td>Serial number</td>
<td>23181292873</td>
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<tr>
<td>Mode</td>
<td>VAuto</td>
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</tr>
<tr>
<td>Max IPAP</td>
<td>16 cmH2O</td>
<td></td>
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</tr>
<tr>
<td>Min EPAP</td>
<td>8 cmH2O</td>
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</tr>
<tr>
<td>Pressure Support</td>
<td>4 cmH2O</td>
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</tr>
<tr>
<td><strong>Therapy</strong></td>
<td></td>
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<tr>
<td>Leaks - L/min</td>
<td>Median: 1.7</td>
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<tr>
<td></td>
<td>95th percentile: 10.4</td>
<td></td>
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<tr>
<td></td>
<td>Maximum: 24.6</td>
<td></td>
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<tr>
<td>Events per hour</td>
<td>AI: 19.7</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>HI: 0.8</td>
<td></td>
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<tr>
<td></td>
<td>AHl: 20.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apnea Index</td>
<td>Central: 2.6</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Obstructive: 16.8</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Unknown: 0.2</td>
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<td></td>
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<tr>
<td><strong>Usage - hours</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>![Usage Graph]</td>
<td></td>
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</tr>
</tbody>
</table>
NASAL PRESSURIZED DEVICE

- Not currently FDA approved
- The concept of CPAP with the simplicity of nasal valve

Zinc-battery powered pressure device
WEIGHT LOSS SURGERY

- Surgical weight loss is the only weight loss that has consistently reduced AHI.
NON BARIATRIC SURGERY FOR OSA

• Maxillomandibular advancement
• Tongue reduction surgery
• Genioglossus advancement
• Uvulopalatopharyngoplasty
• Nasal surgeries
• Hypoglossal nerve stimulators
GOALS OF TREATMENT

• Resolution of sleep apnea (AHI < 5 events per hour).
• Improvement in sleep quality
• Possible increase in sleep quantity
• Improvement in health related measures
SUMMARY

• Obstructive sleep apnea is a condition that affects many people and occurs more commonly in those with risk factors.

• Diagnostic testing is available and easier for patients.

• There are a number of treatment options to help the patient have resolution to their OSA.

• Treatment of OSA is imperative to improve health related outcomes and modify other disease states.
THANK YOU!

QUESTIONS?