The CPAP Skeptic and the Sleep Lab

Anita V. Shelgikar, MD
Sleep Medicine Fellowship Director,
Assistant Professor, Neurology, University of Michigan;
Ann Arbor, Michigan

Objectives:
• Identify common barriers to CPAP use
• Discuss treatment options available to CPAP-refectory patients
• Describe the potential advantages and role of PAP-NAPs for patients with obstructive sleep apnea
The CPAP Skeptic and the Sleep Lab

A Story Inspired by Actual Events

Anita Valanju Shelgikar, MD
April 26, 2013
Table of Contents

Chapters:

1. Meet DF
2. A Night in the Lab
3. Much Ado about Masks
4. I Can't Do This
5. A Begrudging Second Chance
6. Hope
Chapter 1

MEET DF
Sleep Medicine Evaluation

• 86 year old woman

• Recently diagnosed pulmonary HTN
  – Overnight oximetry:
    • mean SpO₂: 93%
    • Nadir SpO₂: 80%
    • 3.1% of recording time with SpO₂ <89%
  – Started on supplemental O₂ at 2 L/min during sleep
  – Referred to Sleep Disorders Clinic
Sleep History

- Wakes with headache (3.5 months)
  - Nocturnal sleep or daytime nap
  - Supplemental O₂ has not helped
- More irritable in recent months
- Recently, briefly drove the wrong way down a one-way street due to inattention.
- Epworth Sleepiness Scale score: 4
  - 2 cups of coffee daily
Sleep History

- Denies snoring, witnessed apneas
- Often wakes with dry mouth
- Frequent nasal congestion
- Time in bed: 10 pm – 6 am
  - Estimates 4-7 hours of sleep
  - Nocturia, thought rumination
- Naps 2-3 times per week
  - 2-5 hours per nap
Past Medical History

• Pulmonary hypertension
• CAD
• Stroke (lacunar stroke x 2)
• Hyperlipidemia
• Sinus bradycardia
• Paroxysmal atrial fibrillation
• Pacemaker Placement
• S/P cardiac arrest 2007
• T12 compression fracture
• DJD of C-spine and L-spine
• Chronic kidney disease, stage 3

- GERD
- Hiatal hernia
- Schatzki’s ring
- Hypertension
- Hypothyroidism
Physical Exam

- BP: 125/57
- BMI: 21.1kg/m²
- Neck circumference: 13 inches
- Mallampati Class IV
- Mandibular evaluation: Normal
- Nares: Narrow
  - Nasal turbinate hypertrophy
Chapter 2

A NIGHT IN THE LAB
Baseline Polysomnogram

- Obstructive apneas, mixed apneas
- Hypopneas (with and without obstructive features)
- Central apneas (periodic breathing pattern; index 13.3/hour)

AHI 56.2/hour
Supine-REM AHI: 70.9/hour
SpO₂ nadir: 75%
CPAP Titration

• Rare central apneas (index 1.4/hour)

• Best: 16 cm of water with Cflex 3
  – Tested in supine position
  – Not tested in REM sleep

• Mask:
  – ResMed Mirage Quattro ex-small
  – ResMed Medium headgear
Clinic Follow-up

- Great difficulty with mask fit

- Nasal pillow mask with chin strap
  - Persistent mouth breathing

- Full-face mask
  - Had to tighten headgear
    - “So much it hurt my nose.”
  - Mask leak with tightened headgear
Clinic Follow-up

- Feels "suffocated" with mask
  - Discontinued CPAP
  - Resumed supplemental $O_2$ use
46-83%
CPAP Non-Adherence

• When defined as \( \leq 4 \) hours/night use
  – Reports range 46 to 83%

• Pattern of adherence:
  – Established during first week of use
    • Even as early as the first 3 days
  – Early pattern predicts long-term use
Budhiraja R; Parthasarathy S; Drake CL. Early CPAP use identifies subsequent adherence to CPAP therapy. SLEEP 2007;30(3):320-324.
What Affects CPAP Adherence?
Factors that Affect CPAP Adherence

- Disease
- Patient
- Treatment titration
- Device factors
- Treatment side effects
- Psychological and social factors
CPAP Adherence

• Disease severity
  – Conflicting data about whether greater severity of OSA predicts better CPAP adherence

• Patient DF:
  – AHI 56.2/hour, $\text{SpO}_2$ nadir 75%
CPAP Adherence

• Patient characteristics
  – Nasal resistance (acoustic rhinometry)
  – Personality type, mood
  – Race
  – Socioeconomic status

• Patient DF:
  – Frequent nasal congestion
  – “Irritable”, no history of depression
  – Caucasian
  – Retired teacher
CPAP Adherence

• PAP titration: In-lab vs. Auto-PAP
  – Retrospective review: in-lab with better adherence at 4-6 weeks
  – Randomized trial: auto-PAP vs. split-night study showed no significant difference in adherence
  – Adherence with auto-PAP may be better in certain groups

• Patient DF:
  – *In-lab titration; CPAP 16 cm of water*
CPAP Adherence

• Device factors
  – Effect of mask on adherence: limited studies
    • Mask type and mask changes
    • Fit
    • Leak

• Patient DF:
  – Mask fit was her biggest barrier to CPAP use
CPAP Adherence

• Treatment side effects
  – Nasal and oral dryness*
  – Difficulty exhaling against pressure*
    *do not affect adherence; intervention may help in a subset of patients
  – Claustrophobia (may lower adherence)

• Patient DF:
  – Reported no treatment side effects
CPAP Adherence

• Psychosocial factors
  – Problem solving skills
  – Optimism about benefit of CPAP
  – Self-efficacy (motivation, confidence)
  – Social and spousal support

• Patient DF:
  – Questioned need for CPAP use
  – Strong family support
I CAN’T DO THIS
What if other treatments are not acceptable?
Improving Adherence (Salvage CPAP)

- Cognitive-behavioral therapy
- Medication use
- PAP-NAP
Cognitive-Behavioral Therapy

- Randomized controlled trial, 142 middle-aged patients, severe OSA
  - Treatment groups:
    - 13-week protocol
    - motivational enhancement therapy
    - education
  - Lower discontinuation rates in both treatment groups vs. standard of care group
Cognitive-Behavioral Therapy

• RCT of 100 middle-aged adults with moderately severe OSA
  – Treatment:
    • CBT after diagnosis, before home CPAP
    • Group setting, participant + spouse
  – Intervention group
    • Higher CPAP adherence at 1 week and 1 month compared to control group
Pharmacologic Intervention

• Randomized, placebo-controlled study
  – 160 adults starting CPAP therapy
  – 2-week course of eszopiclone
  – Significant increase in CPAP in treatment group over 6-month follow-up period
PAP-NAP
CPAP Clinics (per Krakow et. al.)

- (1) Many sleep centers or labs operate CPAP clinics without receiving any reimbursement;

- (2) Resource use in these clinics varies based on the need to balance available time to enhance patient care with the lack of reimbursement.
PAP-NAP

• Billing code: **95807-52**
  – Attended study
  – Cardio-Respiratory Study, 4 or more sensors:
    • Ventilation
    • Respiratory Effort
    • ECG or Heart Rate
    • $O_2$ Saturation
Initial Data, PAP-NAP

• 39 patients
  – Insomnia
  – Psychiatric disorders or symptoms
  – Sleep-disordered breathing
  – Resistance to PAP therapy

  – Compared to 60 historical controls
Step 1: Pre-Test Instructions

– Previous night sleep restrict (1-3 hours)
– No napping prior to PAP-NAP
– No caffeine day of or night prior to study
– Arrange ride to and from clinic
– Have lunch prior to nap period to induce sleepiness
Step 2: Introduction of PAP Therapy and Barrier Assessment

– Mask fitting, desensitization
– Pressure desensitization
– Assess and address
  • Weak Emotional Processing Skills/Anxiety
  • Weak Mental Imagery Skills
Step 3: PAP Therapy Hookup

• 10-channel hookup
  • Pressure transducer
  • Snore
  • PAP therapy pressure
  • Mask leak
  • Respiratory effort belts
  • Heart rate
  • Pulse oximetry
  • Video monitoring
  • Body position
Step 4: PAP Therapy Testing

- 60 - 120 minutes spent in bed with PAP device in place
  - Success measured by subjective sleep or patient’s ability to tolerate PAP use despite not falling asleep
  - Sleep not scored
  - Presumptive sleep based on:
    - heart rate, respiratory rate, and/or presence of snore
Step 5: Post-Test Follow-Up

- Review preliminary results with patient
- Assess patient’s motivation for full or split-night titration
- Schedule titration/split-night or clinic appointment
Effect on CPAP Adherence

- **Definition:**
  - 5 nights/week, 4 hours/night
  - Average hourly calculated:
    - Denominator consisting of all days for the time interval studied, whether PAP therapy was used or not on any given day.

- **Nap-tested group**
  - Adherence was 49% on this model compared to 12% in controls ($p = 0.00$)
### Table 6—Current Use And Adherence Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>NAP Tested (n = 39)</th>
<th>Control (n = 60)</th>
<th>Total (n = 99)</th>
<th>p value&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Regular PAP Therapy Use</strong>&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26 (67)</td>
<td>14 (23)</td>
<td>40 (40)</td>
<td>0.00</td>
</tr>
<tr>
<td>No</td>
<td>13 (33)</td>
<td>46 (77)</td>
<td>59 (60)</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly PAP Therapy Use, %&lt;sup&gt;★★&lt;/sup&gt;</strong></td>
<td>84.66 ± 12.78</td>
<td>76.67 ± 23.13</td>
<td>82.13 ± 16.84</td>
<td>0.18</td>
</tr>
<tr>
<td>Hours/Night PAP Use Based Only on Nights Used in the Month&lt;sup&gt;★&lt;/sup&gt;</td>
<td>6.22 ± 1.37</td>
<td>5.78 ± 1.82</td>
<td>6.08 ± 1.51</td>
<td>0.42</td>
</tr>
<tr>
<td>Hours/Night PAP Use Based on All Nights in the Month&lt;sup&gt;★&lt;/sup&gt;</td>
<td>5.24 ± 1.74</td>
<td>4.46 ± 2.71</td>
<td>5.00 ± 2.09</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Adherence based on CPAP use of ≥5d/wk and ≥ 4h/d avg. on days used&lt;sup&gt;★★★&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22 (56)</td>
<td>10 (17)</td>
<td>32 (32)</td>
<td>0.00</td>
</tr>
<tr>
<td>No</td>
<td>17 (44)</td>
<td>50 (83)</td>
<td>67 (68)</td>
<td></td>
</tr>
<tr>
<td><strong>Adherence based on CPAP use of ≥ 5d/wk and ≥ 4h/d avg. for all days including days not used&lt;sup&gt;★★★★&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19 (49)</td>
<td>7 (12)</td>
<td>26 (26)</td>
<td>0.00</td>
</tr>
<tr>
<td>No</td>
<td>20 (51)</td>
<td>53 (88)</td>
<td>73 (74)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>§</sup>Dichotomous variables expressed as n (% of total) and continuous variables expressed as mean ± SD.
<sup>★</sup>p value determined using χ² analysis for dichotomous variables and One-Way ANOVA for continuous variables.
<sup>★</sup>*Obtained from individual PAP machine data downloads (n = 26 for NAP tested group and n = 14 for control group).
<sup>★★</sup>% based on number of nights of actual use in potential 30 day period.
<sup>★★★</sup>Based on study by Kribbs et al.<sup>(20)</sup>
<sup>★★★★</sup>Based on study by Pepin et al.<sup>(22)</sup>
PAP-NAP

- Medicare reimbursement: $515.29
- Technical component: $451.68
- Professional component: $63.60

- Amount billed is set by billing department
- Commercial reimbursement varies per contract
- No ‘easy’ method to find reimbursement or billing amounts
Chapter 5

A BEGRUDGING SECOND CHANCE
Clinic Follow-up

• Open to retrying CPAP
  – Concerned about the mask
  – Asked about a "pediatric mask"
  – Questions about oral appliance

• Plan: PAP-NAP
• Preferred Equipment:
  – ResMed Quattro FX Full Face mask Small
  – Standard headgear
  – Humidifier: Heated.

• Masks Tried:
  – Swift FX & Bella: liked it at first and then stated that "I just don't like it, I’m uncomfortable".
  – F/P Eson: patient just didn’t like it she stated "it is too much".
  – F/P Pilairo: patient didn’t like it as well.
• **Pre-Trial Observations:**
  
  – Patient was initially on nasal pillows, but had trouble keeping her mouth closed in spite of using the chin strap. She says she never liked chin straps.

  – Subsequently she was changed to full face mask, which made her develop sores on her nose due to the tight head gear.

  – Patient has bad nasal congestion and is a regular mouth breather.

  – Patient tried several masks before she stated that she was comfortable with the Quattro FX Full face mask. Patient stated "I think this is the one" when we tried the Quattro FX on her. Patient wore this mask and fell asleep with comfort.
• Sleep Technologist’s Observations:
  – Tech asked patient how last night’s sleep went.
    – Went to bed at 11am, woke 3 times
    – Out of bed for the day at 5:15 am.
    – Patient stated this was a normal night for her.
  – Daughter stated, “She sleeps all the time.” Patient was alert, pleasant, stating she is tired.
  – About her use of CPAP
    – Stated she hadn't worn her mask in quite a few months. It was leaking, causing lots of noise.
    – When she would tighten the mask, she got sores on her nose.
    – Would take it off at bathroom breaks, not put it back on. Patient stated she sleeps with her mouth open, was not a fan of the chinstrap, hence her mask was a full face.
• **Sleep Technologist’s Observations:**
  – Since she has not been wearing it, she wakes up with a sore throat, headache and sometimes slight nausea.
    • Tech explained that these are all common symptoms of apnea.
  
  – She sometimes has difficulty falling asleep. While awake, she worries about her memory.
  
  – Tech then proceeded to explain mental imagery technique to patient and explained the benefits of relaxation.
    • Patient understood this very well, stating she'll use this tool in the future.
  
  – She also stated she has runny noses and congestion.
    • Therefore we used humidity and explained the benefit, this should help with oxygen drying out her nose.
## Respiratory Analysis

<table>
<thead>
<tr>
<th>Metric</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure (cmH2O)</td>
<td>18.9</td>
<td>4.2</td>
<td>11.7</td>
<td>4.0</td>
<td>5.4</td>
<td>14.0</td>
<td>7.0</td>
<td>54.9</td>
<td>8.9</td>
<td>38.1</td>
</tr>
<tr>
<td>Duration of time at pressure (min)</td>
<td>40</td>
<td>5.2</td>
<td>11.7</td>
<td>4.0</td>
<td>9.3</td>
<td>9.4</td>
<td>8.7</td>
<td>9.8</td>
<td>8.9</td>
<td>38.1</td>
</tr>
<tr>
<td>Estimated Sleep time (EST, min)</td>
<td>2.0</td>
<td>4.5</td>
<td>11.5</td>
<td>4.0</td>
<td>4.5</td>
<td>14.0</td>
<td>7.0</td>
<td>13.5</td>
<td>8.5</td>
<td>34.0</td>
</tr>
<tr>
<td>Apneic Episodes (#)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apnea/hypopnea Index (AHI)</td>
<td>0.0</td>
<td>56.9</td>
<td>56.4</td>
<td>44.6</td>
<td>66.7</td>
<td>38.6</td>
<td>51.6</td>
<td>13.4</td>
<td>6.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Mean % SpO2</td>
<td>97</td>
<td>96</td>
<td>96</td>
<td>97</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Min % SpO2</td>
<td>95</td>
<td>95</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>0</td>
<td>95</td>
<td>0</td>
</tr>
</tbody>
</table>
Interpretation

• This is a PAP NAP study during which, after trying several masks, the patient found she much preferred the Quattro FX full face mask.

• This mask, and her home oxygen of 2 liters per minute, were utilized. CPAP was titrated form 4 -14 cm of water.

• Patient slept for a total time of 104 minutes.

• Patient liked the mask tested and felt like she slept better.

• She mentioned the study helped her and she sees herself wearing the mask more regularly.
After the PAP-NAP

- Patient is still becoming accustomed to CPAP therapy
- Still using her mask
- Scheduled for ongoing follow-up
Chapter 6

HOPE
Importance of OSA Treatment

• Untreated OSA is associated with multiple medical comorbidities

• Can yield improvement in sleep quality and quality of life
Difficulty with CPAP Adherence

• With use of multiple intervention modalities, we can provide better care for our patients
  * Close clinical monitoring
  * Team approach
Affordable Care Act

• Growing emphasis on:
  – Coordination of care
  – Quality of care
  – Patient safety
  – Cost reduction

• We have an opportunity to accomplish all of these and best meet the needs of our patients
Sequel to follow:

LOOKING FORWARD…
References

- Budhiraja R; Parthasarathy S; Drake CL. Early CPAP use identifies subsequent adherence to CPAP therapy. SLEEP 2007;30(3):320-324.
- Platt AB; Field SH; Asch DA; Chen Z; Gupta R; Roche DF; Gurubhagavatula I; Christie JD; Kuna ST. Neighborhood of residence is associated with daily adherence to CPAP therapy. SLEEP 2009;32(6):799-806.
References


- Krakow B; Ulibarri V; Melendrez D; Kikta S; Togami L; Haynes P. A daytime, abbreviated cardio-respiratory sleep study (cpt95807-52) to acclimate insomnia patients with sleep disordered breathing to positive airway pressure (pap-nap). J Clin Sleep Med 2008 ;4(3):212-222.
Thank You

• Kevin Shilling, MD

• Intermountain Healthcare

• UM Sleep Disorders Center