SLEEP DISORDERED BREATHING AND CHRONIC LUNG DISEASE: UPDATE ON OVERLAP SYNDROMES

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LA JOLLA, CA

Robert L. Owens, MD, is a physician-scientist at the University of California San Diego trained in Pulmonary, Critical Care and Sleep Medicine. He received his MD from Columbia University, The College of Physicians and Surgeons and completed his residency in Internal Medicine and fellowship in Pulmonary and Critical Care Medicine at Massachusetts General Hospital. He attends in the medical intensive care unit and in the outpatient sleep medicine clinic. His research has been funded by the NIH and is focused on 1) the pathogenesis of obstructive sleep apnea and 2) sleep disordered breathing and chronic lung disease, and 3) sleep in the hospital/ICU.

Dr. Owens is a member of the American Thoracic Society where he is active in the Sleep and Respiratory Neurobiology Assembly, and the Scientific Advisory Committee. He is also an Associate Editor for the Journal of Clinical Sleep Medicine.

Dr. Owens spends most of his time outside of the office trying to keep up with his daughters, ages 4 and 6.

OBJECTIVES:
Participants should be better able to:

1. To understand that the normal changes in breathing make sleep a “stress test” for those with chronic lung disease.

2. To recognize that overlap syndromes are common and clinically relevant.

3. To recognize that sleep complaints and nocturnal hypoxemia may be symptoms of upper, not lower, airways disease.

SATURDAY, MARCH 24, 2018  10:30 AM
Sleep Disordered Breathing and Chronic Lung Disease: Update on Overlap Syndromes

Robert L. Owens, MD
March 23\textsuperscript{rd}, 2018
NAMDRC 2018 Annual Conference

Disclosures

• ResMed – honorarium and travel reimbursement

• Peter C. Farrell Sleep Center of Excellence at UCSD

• Itamar Medical – honorarium and travel reimbursement

• Novartis – Consulting Fees
Take Home Messages

• Sleep and Chronic Lung Disease is *interesting*

• The normal changes in breathing make sleep a stress test for those with chronic lung disease

• Overlap syndromes are common and clinically relevant
Sleep and Chronic Lung Disease: Asthma

• Sir Jon Floyer, 1698

“I have observed the fit always to happen after sleep in the night where nerves are filled with windy spirits and the heat of the bed has rarefied the spirits and humors”

“by late sitting up I have put by the Fit for a Night or two.”

Bronchial constriction as cause of asthma, pulse rate

Cold baths

Sleep and Chronic Lung Disease: Asthma

• Henry Hyde Salter

“In 19 cases out of 20 ... the dyspnea first declares itself on the patient’s waking in the morning, or rather wakes him from his sleep when he has had but half a night’s rest.”

“The fact is, sleep favors asthma.”

Coffee to ward of sleep? Coffee and tea contain trace amounts of theophylline?
Sleep and Chronic Lung Disease: COPD

Nocturnal deaths among patients with chronic bronchitis and emphysema

Times of death of patients with chronic bronchitis and emphysema compared with two control groups. Figures are numbers of patients dying

<table>
<thead>
<tr>
<th>Diagnoses</th>
<th>7 am-3 pm (day)</th>
<th>3 pm-11 pm (evening)</th>
<th>11 pm-7 am (night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control groups:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-respiratory neoplasms (n=54)</td>
<td>19</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Cerebrovascular disease (n=54)</td>
<td>16</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Bronchitis and emphysema (n=54)</td>
<td>11</td>
<td>17</td>
<td>26*</td>
</tr>
<tr>
<td>Type 1 respiratory failure (n=17)</td>
<td>3</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Type 2 respiratory failure (n=24)</td>
<td>6</td>
<td>3</td>
<td>15**</td>
</tr>
</tbody>
</table>

Significance of difference in numbers of deaths from other time periods: *p < 0.05; **p < 0.01.

McNicholas BMJ 1984

Sleep and Chronic Lung Disease: COPD

- More than half report poor sleep (by PSQI)
- 20% take pharmacological sleep aids regularly

Geiger-Brown Int J COPD 2015
Take Home Messages

• Sleep and Chronic Lung Disease is *interesting*

• The normal changes in breathing make sleep a stress test for those with chronic lung disease

• Overlap syndromes are common and clinically relevant
Ventilation decreases during sleep

- Minute ventilation
- Tidal Volume
- Respiratory rate

Carbon dioxide increases during sleep

Patients with hypercapnia?

Douglas Thorax 1982

Douglas Am Rev Respir Dis 1982
Other changes make it harder to breathe

- Decreased respiratory muscle activity
- End-expiratory lung volume decreases ~500mL
- Increased upper airway resistance

- Rapid eye movement (REM) sleep:
  - Muscle atonia
  - Irregular respiratory pattern
  - Increased pulmonary artery pressures

Low awake O2 saturation can drop during sleep
Nocturnal Oxygen Desaturation (NOD)

Consequences of NOD in COPD
Nocturnal CO$_2$ Increase (NCI)

Take Home Messages

• Sleep and Chronic Lung Disease is *interesting*

• The normal changes in breathing make sleep a stress test for those with chronic lung disease

• Overlap syndromes are common and clinically relevant
Overlap Syndromes (OSA + lung disease)

Are Overlap Syndromes like Reese’s Peanut Butter Cups??
Overlap Syndromes???

• Does one disease **predispose** to the other?

• Do the diseases **interact** (negatively)?

• Does **treatment** of one disease modify the course of the other?

INVITED REVIEW SERIES:
RESPIRATORY SLEEP DISORDERS
SERIES EDITORS: PETER EASTWOOD, MARY MORRELL AND ATUL MALHOTRA

**The overlaps of asthma or COPD with OSA: A focused review**

ROBERT L. OWENS, 1 © MADALINA M. MACREA2 AND MIHAELA TEODORESCU3,4

Respirology 2017
Asthma and OSA

• Does one disease predispose to the other?

• Do the diseases interact (negatively)?

• Does treatment of one disease modify the course of the other?

Original Investigation

Association Between Asthma and Risk of Developing Obstructive Sleep Apnea

Mihaela Teodorescu, MD, MS; Jodi H. Barnet, MS; Erika W. Hagen, PhD; Mari Palta, PhD; Terry B. Young, PhD; Paul E. Peppard, PhD

• Prevalence of OSA in selected asthma cohorts has been very high

• Using the Wisconsin Sleep Cohort, found higher OSA incidence in those with asthma
  • Controlling for sex, age, baseline and change in BMI
Question #1.

• The mechanism by which asthma predisposes to OSA is:

  • A. via increased upper airway inflammation and resistance
  • B. via the use of inhaled corticosteroids, which worsen upper airway collapsibility
  • C. Changes in lung volume that occur during sleep
  • D. Not known, but may include some of the above
Question #1.

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  - C. Changes in lung volume that occur during sleep
  - D. Not known, but may include some of the above

How might one predispose to the other?

- Changes in lower airways inflammation
  - Remodeling
  - Reduced lung stretch

- Nasal/Mucosal inflammation
- Sleep alterations in lung volumes
- Sleep Deprivation
- Local myopathy

- Obesity
- Gastro-esophageal reflux

OSA  ➔  Asthma / COPD
Asthma is an upper airway disease, too

Asthma → OSA?

Montelukast for Children with Obstructive Sleep Apnea: Results of a Double-Blind, Randomized, Placebo-Controlled Trial

Leila Kheirandish-Gozal, Hari P. R. Bandla*, and David Gozal

Asthma → OSA?
Asthma and OSA

• Does one disease predispose to the other?  
  Probably

• Do the diseases interact (negatively)?

• Does treatment of one disease modify the course of the other?
OSA is reported to be common in severe asthma

**TABLE III. Prevalence of OSAH**

<table>
<thead>
<tr>
<th>Threshold criterion</th>
<th>Severe</th>
<th>Moderate</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total AH1 ≥15 events/h</td>
<td>23/26 (88)</td>
<td>15/26 (58)</td>
<td>8/26 (31)</td>
</tr>
<tr>
<td>WAHI ≥5 events/h</td>
<td>13/26 (50)</td>
<td>6/26 (23)</td>
<td>3/26 (12)</td>
</tr>
<tr>
<td>WAHI ≥5 events/h with excessive sleepiness (Epworth sleepiness score ≥ 11)</td>
<td>11/26 (42)</td>
<td>4/26 (15)</td>
<td>1/26 (4)</td>
</tr>
</tbody>
</table>

Similar Age and BMI

Julien JACI 2009

Are nocturnal asthma symptoms due to OSA?

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

- 4 or more nights a week [1]
- 2 to 3 nights a week [2]
- Once a week [3]
- Twice [4]
- Not at all [5]

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

- 3 or more times per day [1]
- 1 to 2 times per day [2]
- 2 or 3 times per week [3]
- Once a week [4]
- Not at all [5]

Does OSA make asthma harder to “control”?
### Identification of Asthma Phenotypes Using Cluster Analysis in the Severe Asthma Research Program

Wendy C. Moore1,2, Deborah A. Meyers1,2, Sally E. Wenzel3, W. Gerald Teague4, Huaxin Li5, Xingnan Li5, Ralph D’Agostino, Jr.3, Mario Castro3, Douglas Curran-Everett3, Anne M. Fitzpatrick3, Benjamin Castro3, Nizar N. Jarjour4, Ronald Sorkness5, William J. Calhoun6, Kian Fan Chung7, Suzy A. A. Cornhaim2, Raed A. Dweik2, Elliot Israel1, Stephen P. Peters1,2, William W. Busse3, Serpill C. Erzuurnu3, and Eugene R. Bleeker1,2,

for the National Heart, Lung, and Blood Institute’s Severe Asthma Research Program

<table>
<thead>
<tr>
<th></th>
<th>Total Cohort</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
<th>Cluster 5</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>726</td>
<td>110</td>
<td>321</td>
<td>59</td>
<td>120</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Age at enrollment, years</td>
<td>37 (1-47)</td>
<td>27 (8)</td>
<td>33 (12)</td>
<td>30 (6)</td>
<td>38 (13)</td>
<td>49 (11)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Sex, % female</td>
<td>66</td>
<td>80</td>
<td>67</td>
<td>71</td>
<td>53</td>
<td>63</td>
<td>0.0006</td>
</tr>
<tr>
<td>Race, % White/AA/other</td>
<td>64/28/8</td>
<td>62/29/9</td>
<td>63/30/7</td>
<td>73/22/5</td>
<td>62/33/5</td>
<td>68/20/12</td>
<td>0.17</td>
</tr>
<tr>
<td>Body mass index (BMI)</td>
<td>29 (6)</td>
<td>27 (3)</td>
<td>28 (8)</td>
<td>33 (9)</td>
<td>31 (9)</td>
<td>31 (7)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>% with BMI &gt;30</td>
<td>57</td>
<td>24</td>
<td>31</td>
<td>58</td>
<td>44</td>
<td>51</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age of asthma onset, years</td>
<td>15 (1-64)</td>
<td>11 (10)</td>
<td>11 (11)</td>
<td>42 (10)</td>
<td>8 (10)</td>
<td>21 (15)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>% with onset ≥12 years of age</td>
<td>46</td>
<td>39</td>
<td>36</td>
<td>100</td>
<td>28</td>
<td>69</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Asthma duration, years</td>
<td>22 (1-46)</td>
<td>15 (9)</td>
<td>22 (12)</td>
<td>9 (7)</td>
<td>30 (14)</td>
<td>29 (15)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Baseline lung function1</td>
<td>74 (22)</td>
<td>102 (11)</td>
<td>82 (11)</td>
<td>75 (11)</td>
<td>57 (12)</td>
<td>43 (14)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>FVC % predicted</td>
<td>86 (19)</td>
<td>112 (10)</td>
<td>93 (9)</td>
<td>80 (8)</td>
<td>72 (12)</td>
<td>60 (13)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>0.70 (0.1)</td>
<td>0.78 (0.1)</td>
<td>0.74 (0.1)</td>
<td>0.74 (0.1)</td>
<td>0.64 (0.1)</td>
<td>0.57 (0.1)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Maximal lung function1</td>
<td>87 (20)</td>
<td>113 (8)</td>
<td>94 (9)</td>
<td>84 (9)</td>
<td>76 (12)</td>
<td>58 (14)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>FVC % predicted</td>
<td>96 (17)</td>
<td>117 (10)</td>
<td>100 (10)</td>
<td>87 (8)</td>
<td>89 (12)</td>
<td>75 (15)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Change in % predicted FEV1</td>
<td>13 (11)</td>
<td>11 (9)</td>
<td>12 (9)</td>
<td>10 (7)</td>
<td>19 (12)</td>
<td>14 (11)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Asthma status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of positive SPT</td>
<td>3.4 (3.0)</td>
<td>3.9 (3.0)</td>
<td>3.6 (3.0)</td>
<td>2.2 (2.5)</td>
<td>4.9 (3.1)</td>
<td>2.6 (2.7)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Subjects with ≥ one positive SPT, %</td>
<td>77</td>
<td>85</td>
<td>78</td>
<td>64</td>
<td>83</td>
<td>66</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

Is this OSA Asthma?

AJRCCM 2010
Asthma and OSA

• Does one disease \textit{predispose} to the other? \textit{Probably}

• Do the diseases \textit{interact} (negatively)? \textit{Probably, may be more important for some}

• Does \textit{treatment} of one disease modify the course of the other?

CPAP to treat OSA in asthma
CPAP prevents nocturnal worsening of asthma

- Nine patients with asthma and OSA .... were studied. All patients suffered from frequent nocturnal asthma attacks, resulting in hospitalizations and respiratory arrests in 3.

- During the period of nCPAP therapy, all patients recorded improvement in their PEFR.

- This study confirms that nCPAP therapy can be used safely in treating patients with OSA and coexisting asthma.

- Furthermore, nCPAP treatment improves the asthma control and, in particular, the nocturnal attacks in this group of patients.
Question #2.

- Treatment of OSA with nasal CPAP in those with asthma:
  - A. Improves the FEV1/FVC ratio
  - B. Improves asthma specific QOL and asthma control
  - C. Causes more asthma exacerbations
  - D. Reduces the need for other asthma medications
Question #2.

- Treatment of OSA with nasal CPAP in those with asthma:
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  - B. Improves asthma specific QOL and asthma control
  - C. Causes more asthma exacerbations
  - D. Reduces the need for other asthma medications
Results: The mean ± SD score of the ACQ decreased from 1.39 ± 0.91 at baseline to 1.0 ± 0.78 at 6 months (P = 0.003), the percentage of patients with uncontrolled asthma from 41.4% to 17.2% (P = 0.006), and the percentage of patients with asthma attacks in the 6 months before and after treatment from 35.4% to 17.2% (P = 0.015). The score of the mAQLQ increased from 5.12 ± 1.38 to 5.63 ± 1.17 (P = 0.009). There were also significant improvements in symptoms of gastroesophageal reflux and rhinitis, bronchial reversibility, and exhaled nitric oxide values (all P < 0.05). No significant changes were observed in drug therapy for asthma or their comorbidities nor in the patients’ weight.

Those with moderate to severe OSA and adherent to PAP therapy have modest improvements in asthma control and QOL
Asthma and OSA

• Does one disease **predispose** to the other?  
  Probably

• Do the diseases **interact** (negatively)?  
  Probably, may be more important for some

• Does **treatment** of one disease modify the course of the other?  
  Yes, though benefit (on average) may be modest
COPD and OSA

Hypopneas (partial airway collapse) defined by hypoxemia

Are there more hypopneas for same UA anatomy?

Oxygen Saturation

Does it matter?

Oxygen in blood, PaO2
Overlap patients can look quite different

• All COPD is not the same

• All OSA is not the same

FEV1 15% + AHI 6/hour = Overlap

FEV1 65% + AHI 70/hour = Overlap
COPD and OSA

• Does one disease predispose to the other?

• Do the diseases interact (negatively)?

• Does treatment of one disease modify the course of the other?

COPD and OSA

• Quite variable estimates depending on group studied

• Low in Sleep Heart Health Study, with mild COPD generally (0.5%)

• Higher in VA population (39%)

• Very high in a pulmonary rehab population with moderate to severe COPD (65%)

Sanders AJRCCM 2003
Lopez-Acevedo Sleep Breath 2009
Soler Annals ATS 2015
Question #3.

• The mechanism by which COPD predisposes to OSA is:

  • A. via a generalized myopathy, that also impacts upper airway muscles
  • B. Destruction of lung tissue, which reduces traction on the upper airway, making it more collapsible
  • C. Sleep deprivation, which impairs upper airway reflexes
  • D. Not known

Question 3 (Owens) - The mechanism by which COPD predisposes to OSA is:

A. via a generalized myopathy, that also impacts upper airway muscles
   - B. Destruction of lung tissue, which reduces traction on the upper airway, making it more collapsible
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  - B. Destruction of lung tissue, which reduces traction on the upper airway, making it more collapsible
  - C. Sleep deprivation, which impairs upper airway reflexes
  - D. Not known

---

How might one predispose to the other?

Changes in lower airways inflammation
Remodeling
Reduced lung stretch

Nasal/Mucosal inflammation
Sleep alterations in lung volumes
Sleep Deprivation
Local myopathy

Obesity
Gastro-esophageal reflux

OSA \[\Rightarrow\] Asthma /COPD
Increased lung volume $\rightarrow$ reduced upper airway collapsibility (Pcrit)

Is hyperinflation protective against OSA?
COPD and OSA

• Does one disease **predispose** to the other?  
  *Not sure*

• Do the diseases **interact** (negatively)?

• Does **treatment** of one disease modify the course of the other?

---

**Co-morbid OSA may increase mortality**

![Graph showing survival rates over years for COPD only, COPD + OSA, COPD + OSA + CPAP. The graph indicates a statistically significant difference (P<0.001) in survival rates between the groups.](Marin AJRCCM 2010)
...And also morbidity

Mechanisms of overlap syndrome mortality???
Mechanisms of overlap syndrome mortality

Further increases in RV remodeling in overlap syndrome

Sharma COPD 2013

Do Overlap Syndrome patients look different from “just” COPD?

<table>
<thead>
<tr>
<th></th>
<th>COPD Group (n = 32)</th>
<th>Overlap Group (n = 29)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.09 ± 10.42</td>
<td>57.22 ± 9.48</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>87.57 ± 17.5</td>
<td>102.19 ± 20.64</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>31.02 ± 6.00</td>
<td>30.23 ± 6.12</td>
</tr>
<tr>
<td>FVC% of predicted</td>
<td>59.53 ± 18.38</td>
<td>72.18 ± 17.18</td>
</tr>
<tr>
<td>FEV₁ % of predicted</td>
<td>47.31 ± 15.76</td>
<td>62.99 ± 16.19</td>
</tr>
<tr>
<td>FEV₁/FVC %</td>
<td>59.25 ± 8.71</td>
<td>66.71 ± 4.89</td>
</tr>
<tr>
<td>PaO₂ (mm Hg)</td>
<td>89 ± 10.19</td>
<td>70.34 ± 10.61</td>
</tr>
<tr>
<td>PaCO₂ (mm Hg)</td>
<td>39.63 ± 4.89</td>
<td>44.59 ± 4.93</td>
</tr>
<tr>
<td>AHI/h</td>
<td>6.09 ± 4.66</td>
<td>40.46 ± 19.98</td>
</tr>
<tr>
<td>TST, SaO₂&lt;90%</td>
<td>15.56 ± 27.63</td>
<td>47.78 ± 27.72</td>
</tr>
</tbody>
</table>

Resta Sleep Breath 2002
COPD and OSA

- Does one disease **predispose** to the other?  
  *Not sure*
- Do the diseases **interact** (negatively)?  
  *Probably*
- Does **treatment** of one disease modify the course of the other?

---

**Co-morbid OSA may increase mortality**

![Graph showing survival rates for COPD only, COPD + OSA, and COPD + OSA + CPAP. The graph indicates that co-morbid OSA may increase mortality, with statistical significance (P<0.001).](Marin_AJRCCM_2010)
More CPAP use associated with improved survival

Less CPAP use

Stanchina JCSM 2013
OSA Screen for patients BMI > 30 kg/m²

84%

Formal Sleep Consult
410

Underwent PSG
149

87%

SDB: 129 (87%)
Severe: 52 (40%)
Mod: 32 (25%)
Mild: 45 (35%)

226 No consult:
83: acute illness/sepsis
42: patient declined
35: discharged early
25: known OSA on therapy
24: terminal illness
8: decreased mental status/dementia
9: not known

Number of patients who underwent overnight polysomnography within 4 weeks of discharge from the hospital substantially improved
In Patients with COPD

Change in number of ER visits and Admissions

Konikkara Hosp Practice 2016

**Effect of Home Noninvasive Ventilation With Oxygen Therapy vs Oxygen Therapy Alone on Hospital Readmission or Death After an Acute COPD Exacerbation: A Randomized Clinical Trial**

Patrick B. Murphy, PhD; Sunita Rehal, MSc; Gill Arbana, BSc (Hons); Stephen Bourke, PhD; Peter M. A. Calverley, PhD; Angela M. Crook, PhD; Lee Dowson, MD; Nicholas Duffy, MD; G. John Gibson, MD; Phillip D. Hughes, MD; John R. Hurst, PhD; Keir E. Lewis, MD; Rahul Mulherjee, MD; Annabel Nickol, PhD; Nicholas O'Croft, MD; Maxine Patout, MD; Justin Pepperell, MD; Ian Smith, MD; John R. Stradling, PhD; Jadwiga A. Wedzicha, PhD; Michael I. Pollkey, PhD; Mark W. Elliott, MD; Nicholas Hart, PhD

2017
Do we need to think about Overlap? Should we just treat with NIV?
How should we treat Overlap Syndrome?

- Optimize COPD therapy, if possible
  - (hypoxemia may improve)

- Evaluate for hypercapnia

- Polysomnography

A management algorithm

Hypercapnia? Based on CO₂ or Ancillary Testing

NIV treatment to stabilize pCO₂

Substantial Hypoxemia?

Yes

Add Nocturnal O₂ if needed
A management algorithm

Hypercapnia? Based on CO₂ or Ancillary Testing

Yes

NIV treatment to stabilize $pCO_2$

No

Clinical suspicion for OSA?

Headaches with $O_2$ therapy

Hypercapnia with preserved FEV1

Symptoms

Routine?

Substantial Hypoxemia?

Yes

Add Nocturnal $O_2$ if needed

RESEARCH ARTICLE

Age, gender, neck circumference, and Epworth sleepiness scale do not predict obstructive sleep apnea (OSA) in moderate to severe chronic obstructive pulmonary disease (COPD): The challenge to predict OSA in advanced COPD

Xavier Soler, Shu-Yi Liao, Jose Maria Marin, Geraldo Lorenzi-Filho, Rachel Jen, Pamela DeYoung, Robert L. Owens, Andrew L. Ries, Atul Malhotra
Hypercapnia? Based on CO₂ or Ancillary Testing

- **Yes**: NIV treatment to stabilize pCO₂
  - Substantial Hypoxemia?
    - Yes: Add Nocturnal O₂ if needed
  - No: Clinical suspicion for OSA

- **No**: AHI < 5
  - **AHI > 5**: Clinical suspicion for OSA

---

AHI > 5?

- Review PSG Respiratory Event
  - **Mainly Apnea or Hypopnea driven by arousal**
    - UPPER AIRWAY COLLAPSE
      - PAP Therapy
      - Alternative Anatomical Therapy (e.g. Weight loss, Dental Device, Positional Therapy, Surgery)
  - **Mainly Hypopnea driven by hypoxemia**
    - COPD PREDISPOSING TO HYPOXEMIA
      - Consider Nocturnal O₂
      - COPD Therapy (Bronchodilator, ICS, Pulmonary Rehab)

- Consider Repeat PSG after Optimal COPD Treatment
Question 4.

• Giving supplemental oxygen to patients with overlap syndrome is:
  • A. Good
  • B. Bad
  • C. Potentially Ugly
Question 4.

- Giving supplemental oxygen to patients with overlap syndrome is:
  
  - A. Good
  
  - B. Bad
  
  - C. Potentially Ugly

An additional L/min of O₂ at night ...
An additional L/min of O$_2$ at night ...

![Graph showing the effect of additional oxygen on blood pressure.](Image)

Samolski Respirology 2011

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OXYGEN SATURATION DURING REPETITIVE OBSTRUCTIVE APNEAS

![Graph showing oxygen saturation during sleep.](Image)

Alford Chest 1986
COPD and OSA

- Does one disease predispose to the other?  
  Not sure

- Do the diseases interact (negatively)?  
  Probably

- Does treatment of one disease modify the course of the other?  
  Yes, appears to.  
  DON’T correct upper airway obstruction with oxygen alone
Overlap Syndromes (OSA + lung disease)

Degree of oxygen desaturation

IPF
Cystics
Sleep Apnea Syndrome

“Blue Bloaters”
“Pink Puffers”

Hypoxemia?
How much is driven by hypopneas?

Adapted from Flenley Clin Chest Med 1985

Obstructive Sleep Apnea Is Common in Idiopathic Pulmonary Fibrosis

Lisa H. Lancaster, MD, FCCP, Wendi R. Mason, MSN, ACNP-BC;
James A. Farnell, BS; Todd W. Rice, MD, FCCP; James E. Loyd, MD, FCCP;
Aaron P. Milstone, MD, FCCP; Harold R. Collard, MD, FCCP; and
Beth A. Malow, MD

Conclusions: OSA is prevalent in patients with IPF and may be underrecognized by primary care providers and specialists. Neither ESS nor SA-SDQ alone or in combination was a strong screening tool. Given the high prevalence found in our sample, formal sleep evaluation and polysomnography should be considered in patients with IPF. (CHEST 2009; 136:772–778)
Obstructive Sleep Apnea and Subclinical Interstitial Lung Disease in the Multi-Ethnic Study of Atherosclerosis (MESA)

John S. Kim1, Anna J. Podolanczuk1, Priya Borker2, Steven M. Kawut3, Ganesh Raghu4, Joel D. Kaufman4,5, Karen D. Hinckley Stukovský6, Eric A. Hoffman7, R. Graham Ban1,8, Daniel J. Gottlieb9,10, Susan S. Redline3,9, and David J. Lederer1,9x

Conclusions: Moderate to severe OSA is associated with subclinical ILD and with evidence of alveolar epithelial injury and extracellular matrix remodeling in community-dwelling adults, an association that is strongest among normal-weight individuals. These findings support the hypothesis that OSA might contribute to early ILD.

Mechanism?

- IPF → OSA
  - Low lung volumes?
  - Steroids?
- IPF ← OSA
  - Lung stretch?

“OSA is likely to be common not only in patients with IPF but even in those with early disease. Again, symptoms that are sometimes ascribed to IPF, such as fatigue and poor sleep, might actually be due to OSA.”

Can a Floppy Upper Airway Lead to Stiff Lungs?

Rachel K. Putman1 and Robert L. Owens2
Take Home Messages

• Sleep and Chronic Lung Disease is *interesting*

• The normal changes in breathing make sleep a stress test for those with chronic lung disease

• Overlap syndromes are common and clinically relevant

Take Home Messages

• Not all sleep complaints are due to lower airways disease

• Not all nocturnal hypoxemia is due to lower airways disease

• While hard outcome benefit remains to be clearly demonstrated, ability to improve QOL, sleepiness, fatigue by considering overlap syndromes
Thank you

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