ROLE OF CPAP AND BIPAP IN REDUCING HOSPITAL READMISSIONS

SAIRAM PARTHASARATHY, MD

ASSOCIATE PROFESSOR OF MEDICINE
UNIVERSITY OF ARIZONA COLLEGE OF MEDICINE
TUCSON, AZ

Sairam “Sai” Parthasarathy, MD, is a NIH- and PCORI-funded researcher who serves as an Associate Professor of Medicine, Director of Center for Sleep Disorders, and Associate Director for ARC at the University of Arizona. Sai’s research focuses on the relationship between sleep, breathing, and inflammation in both ambulatory and critically ill patients. Additionally, he has been involved in clinical trials of novel modes of ventilatory assistance for patients with sleep-disordered breathing (such as servo-ventilation and volume-assured pressure support) as well as health services research aimed at improving healthcare delivery and promoting CPAP adherence in patients with sleep-disordered breathing.

Sai is committed to the training and fostering of new physician-investigators in sleep disorders. He was involved in the development and conduct of the Young Investigator Research Forum for the past 6 years. He serves as the program director for sleep medicine at the University of Arizona and is involved in training clinical and research fellows in sleep medicine.

Sai served as Chairman of the Sleep Disorders Research Advisory Board (SDRAB) to the National Center for Sleep Disorders Research (NIH/NHLBI) for a 2-year term ending 2014. Currently he is an Associate Editor for the journals SLEEP and Journal of Clinical Sleep Medicine, and is on the Editorial board of the American Journal of Respiratory and Critical Care Medicine.

He previously served as the Chair of the Research Committee of the American Academy of Sleep Medicine, Chair of Young Investigator Forum conducted at the NIH, as an ad-hoc reviewer for NIH review sections, and is currently serving as a standing member for the grant review committee for the Patient Centered Outcomes Research Institute (PCORI).

He is board certified in Sleep Medicine as well as Pulmonary and Critical Care Medicine and has published over 70 papers and book chapters on sleep- and respiration-related topics. Sai and his wife moved to Tucson, Arizona in 2004 from Chicago and have two daughters and a son who love visiting Scottsdale in the winter!

OBJECTIVES:
Participants should be better able to:

THURSDAY, MARCH 12, 2015 9:45 AM
Role of CPAP and Bilevel PAP in Reducing Hospital Readmissions

Sairam Parthasarathy, MD
Associate Professor of Medicine
Director, Center for Sleep Disorders
University of Arizona
Tucson, AZ
spartha1@email.arizona.edu

Conflict of Interest

<table>
<thead>
<tr>
<th>Affiliation/Interest</th>
<th>Name of Organization(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant/Research Support</td>
<td>Philips-Respironics, Inc. (research grant awarded to University of Arizona); Younes Sleep Technologies, Inc. (Research grant awarded to University of Arizona); Niveus Medical Inc. (Research grant to University of Arizona)</td>
</tr>
<tr>
<td>Consultant</td>
<td>None</td>
</tr>
<tr>
<td>Speakers’ Bureau</td>
<td>None</td>
</tr>
<tr>
<td>Major Stock Holder</td>
<td>None</td>
</tr>
<tr>
<td>Other financial support or material support</td>
<td>Honorarium for participation at the Key Opinion Leadership Summit (2014; for $2,000) Honorarium for contributing educational chapter to UpToDate, Inc. ($600 in last 12 months)</td>
</tr>
</tbody>
</table>
“To study the phenomenon of disease without books is to sail an uncharted sea…

.......while to study books without patients is not to go to sea at all.”

Sir William Osler
1849 - 1919

---

**Background**

- COPD is the third leading cause of death in US
- 12.7 million adults have COPD
- Discharge rate of 23.2 per 100,000 population
- ~65% of COPD-related hospital discharges in > 65 year olds with estimated cost of $50 billion/yr
- 30-day readmission is high 20-39%

Source: American Lung Association
Background - 2

- Currently, Medicare penalizes hospitals for 30-day readmission of patients with COPD
- Patients with COPD and obesity are more likely to be readmitted
- Obese patients are more likely to suffer from OSA
- 29-40% of COPD patients have OSA

Feemster L & Au D, Am J Respir Crit Care Med 2014; 189:634-639
http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Variable Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Oxygen count</td>
<td>Oxygen use; Oxygen saturations; oxygen in blood stream</td>
</tr>
<tr>
<td>2 Symptoms (shortness of breath, cough, etc.)</td>
<td>Presence and severity of shortness of breath, cough, reduced exercise and activity tolerance</td>
</tr>
<tr>
<td>3 Stop smoking</td>
<td>Getting help to stop smoking</td>
</tr>
<tr>
<td>4 Reducing Risk for other coexisting disease/afflictions</td>
<td>Reducing the risk for cancers, heart problems, and other diseases associated with COPD</td>
</tr>
<tr>
<td>5 Prevent Hospitalizations</td>
<td>Prevent hospitalizations through better COPD management (unscheduled visits to ER, office, urgent care included)</td>
</tr>
<tr>
<td>6 Reduce Exacerbations</td>
<td>Influenza and pneumonia vaccinations; Emergency supply of prednisone and antibiotics for early use in illness onset</td>
</tr>
<tr>
<td>7 Improve physical activity</td>
<td>Pulmonary rehabilitation; Daily exercise</td>
</tr>
<tr>
<td>8 Advance directives and Transplant Candidacy</td>
<td>Discussing advance directives and end-of-life wishes and care. Assessing for lung transplant candidacy if eligible. Having difficult and important discussions about COPD condition</td>
</tr>
<tr>
<td>9 Improve sleep</td>
<td>Diagnose and treat insomnia and/or sleep apnea</td>
</tr>
<tr>
<td>10 Patient Education</td>
<td>Up-to-date information about COPD</td>
</tr>
<tr>
<td>11 Slowing the Loss of Lung Function</td>
<td>Prevent further damage to lungs by avoiding risks factors (i.e. smoking) and improving exercise tolerance</td>
</tr>
<tr>
<td>12 Improving General Health Status</td>
<td>Improving sense of well-being through nutrition, exercise, emotional, and spiritual support</td>
</tr>
<tr>
<td>13 Prevent &amp; Treat Complications</td>
<td>Preventing medication risks (i.e. prednisone effects on osteoporosis) and treating complications as they arise</td>
</tr>
<tr>
<td>14 Reduce Death</td>
<td>Reducing the chance of dying due to COPD</td>
</tr>
<tr>
<td>15 Treatment of Mental Comorbidities</td>
<td>Treatment of other mental health issues such as depression, and anxiety</td>
</tr>
<tr>
<td>16 Improve Access to Care</td>
<td>Facilitate fast access to doctors and nurses to enable prompt care in both non-urgent and urgent situation, enable communication between office and patient, provide for clinic availability for patient scheduling as needed</td>
</tr>
</tbody>
</table>
Knowledge Gaps

- Do patients with COPD have reduced 30-day readmission if they are on PAP therapy?
- How comparable are CPAP, bilevel PAP, and ventilator therapy in patients with COPD?
- Do patients with COPD and OSA -- regardless of presence or absence of hypercapnia -- benefit from PAP therapy?
- Can an existent clinical strategy that rapidly detects OSA and initiates PAP therapy reduce readmissions in patients with COPD?
Future Research Needs

“Future research should focus on adequate patient selection, ventilator settings, training and length of ventilation, as well as exacerbation frequency, admissions to hospital and survival.”

Research priorities generally focused on studies to evaluate different approaches to healthcare delivery (e.g., integrated healthcare strategies during transitions in care) rather than head-to-head comparisons of medications

The impact of treatment of sleep-disordered breathing on major long-term clinical outcomes as a high priority

Cochrane Database Syst Rev 2013; 6:CD002878
Am J Respir Crit Care Med 2013; 187:320-326
AHRQ No.12-EHC033-EF

Quality of Care for Patients Hospitalized for Acute Exacerbations of Chronic Obstructive Pulmonary Disease

Implementation Gap

N = 69,820

Lindenauer 2006
Randomized Studies Comparing Noninvasive Positive-Pressure Ventilation with Non-ventilatory Control

**Table 11. Randomized Studies Comparing Noninvasive Positive-Pressure Ventilation with Nonventilatory Control**

<table>
<thead>
<tr>
<th>Study (Reference)</th>
<th>Year</th>
<th>NPPV Group</th>
<th>Control Group</th>
<th>Intervention</th>
<th>Need for Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus et al. (108)</td>
<td>1996</td>
<td>9</td>
<td>8</td>
<td>Nasal, pressure support 4 h once</td>
<td>NR</td>
</tr>
<tr>
<td>Barbe et al. (109)</td>
<td>1996</td>
<td>10</td>
<td>10</td>
<td>Nasal, bilevel positive airway pressure 3 h twice per day</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Bett et al. (110)</td>
<td>1993</td>
<td>30</td>
<td>30</td>
<td>Nasal, volume cycled</td>
<td>8/30 (8)</td>
</tr>
<tr>
<td>Brochard et al. (111)</td>
<td>1995</td>
<td>43</td>
<td>42</td>
<td>Face mask, pressure support</td>
<td>11/43 (26%)</td>
</tr>
<tr>
<td>Kramer et al. (112)</td>
<td>1995</td>
<td>11</td>
<td>12</td>
<td>Nasal, bilevel positive airway pressure ≈8 h/d</td>
<td>1/11 (9%)</td>
</tr>
</tbody>
</table>

* NPPV = noninvasive positive-pressure ventilation; NR = not reported.
† Blood gas improvement was defined differently in different studies. The results reported here are based on the definitions used in each study.
‡ Statistically significant within-group improvement (P < 0.05).
§ Statistical significance for within-group improvement was not reported.


Survival in patients with COPD and OSA

**Survival (%)**

![Survival Curve](image)

- **BMI = 27**
- **BMI = 30**

Severe Exacerbation-free Survival in patients with COPD and OSA


NIPPV Reduces Mortality in Severe Stable Hypercapnic COPD

Selection
PaCO2 ≥ 52 mmHg
Ambulatory COPD with no recent exacerbation

Ineligible
BMI > 35 kg/m²

Goal of therapy
12 Months
PaCO2 < 48 mmHg

Mean Rx
MIP = 21.6 cmH₂O
MEP = 4.8 cmH₂O
Rate = 16 bpm

Home noninvasive ventilation use following acute hypercapnic respiratory failure in COPD

![Graph showing event free survival over days to readmission or death for NPPV post discharge group and no NPPV post discharge group.]


Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure

![Diagram showing patients randomly allocated, with NIV and standard treatment groups. Early drop-outs and drop-outs included with ITT survival analysis.]

Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure


Nocturnal noninvasive positive pressure ventilation in stable COPD: A systematic review and individual patient data meta-analysis

Struik et al; Respiratory Medicine (2014) 108, 329e337

Table 1 Characteristics of included studies.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Study design (compared to treatment)</th>
<th>IFP/EPNP</th>
<th>Study population</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casanova (2000)</td>
<td>Parallel group (LTDT)</td>
<td>12/4</td>
<td>52 randomised patients,</td>
<td>Blood gases, lung function, PImax, MIPmax, dyspnoea after 3 months, Exacerbation rate, hospital admissions, intubations and mortality after 12 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>36 completers, PaCO2 51</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.84 L</td>
<td></td>
</tr>
<tr>
<td>Chokani (2003)</td>
<td>Parallel group (LTDT)</td>
<td>14.4/3.8</td>
<td>90 randomised patients,</td>
<td>Blood gases and hospitalisations after 3 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>78 completers, PaCO2 56</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.75 L</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13 randomised patients,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 completers, PaCO2 56</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.61 L</td>
<td></td>
</tr>
<tr>
<td>Day (1999)</td>
<td>Parallel group (sham)</td>
<td>10/2</td>
<td>22 randomised patients,</td>
<td>Blood gases, 6 MIPmax, lung function, HRV + atrial peptide measurements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17 completers, PaCO2 43</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.88 L</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>19 randomised patients,</td>
<td>Blood gases, walking test, lung function, PImax, MIPmax, sleep study, dyspnoea</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7 completers, PaCO2 46</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.54 L</td>
<td></td>
</tr>
<tr>
<td>Long term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clin (2002)</td>
<td>Parallel group (LTDT)</td>
<td>14.6/3.9</td>
<td>90 randomised patients,</td>
<td>Blood gases, 6 MIPmax, HRQOL, lung function, HRV + atrial peptide measurements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>57 completers, PaCO2 56</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.79 L</td>
<td></td>
</tr>
<tr>
<td>McEvoy (2009)</td>
<td>Parallel group (LTDT)</td>
<td>12.8/5.1</td>
<td>144 randomised patients,</td>
<td>Blood gases, HRQOL, lung function, sleep study (only in NIPPV group), hospitalisation rates, survival</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>81 completers, PaCO2 54</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmHg, FEV1 0.60 L</td>
<td></td>
</tr>
</tbody>
</table>

Struik et al; Respiratory Medicine (2014) 108, 329e337
CONCLUSION: At present, there is insufficient evidence to support the application of routine NIPPV in patients with stable COPD. However, higher IPAP levels, better compliance and higher baseline PaCO$_2$ seem to improve PaCO$_2$.

Struik et al; Respiratory Medicine (2014) 108, 329e337

Nocturnal-NIPPV at home for at least three months in hypercapnic patients with stable COPD had no consistent clinically or statistically significant effect on gas exchange, exercise tolerance, HRQoL, lung function, respiratory muscle strength or sleep efficiency.

Cochrane Database Syst Rev 2013; 6:CD002878
Thorax. 2014; 69(9): 826-34
Retrospective assessment of a Multi-faceted program

A retrospective study of a quality improvement (QI) program performed at a single center whose multifaceted intervention included:

(a) nocturnal administration of advanced positive airway pressure (PAP) modality (or noninvasive positive pressure ventilation [NIPPV])
(b) Education by respiratory therapist (RT),
(c) medication reconciliation by a pharmacist,
(d) adequate provision of oxygen,
(e) and ongoing RT-led care including home-visits.

Coughlin et al; J Clin Sleep Med 2015 [In Press]

Retrospective Assessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease

N = 397

Coughlin et al; J Clin Sleep Med 2015 [In Press]
**Hospitalization or death**

**Unadjusted Odds Ratio**

*P < 0.05; #P < 0.10; †Compared to men

- **SABA**
- **Antibiotics**
- **#Oral steroids**
- **Depression**
- **DM**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Oxygen**
- **Anxiety**
- **HTN #
- **CAD**
- **HF**
- **CAD**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**

Increased risk

Decreased risk

**Coughlin et al; J Clin Sleep Med 2015 [In Press]**

**Hospitalization or death**

**Adjusted Odds Ratio**

- **SABA**
- **Antibiotics**
- **#Oral steroids**
- **Depression**
- **DM**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Oxygen**
- **Anxiety**
- **HTN #
- **CAD**
- **HF**
- **CAD**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**
- **COPD severity**
- **Oxygen level**
- **Pack years**
- **Race**
- **PAP**
- **Sex †
- **Age**

Increased risk

Decreased risk

**Coughlin et al; J Clin Sleep Med 2015 [In Press]**
In a retrospective cohort study of a QI initiative undertaken at a single center, we have observed that a multifaceted intervention that involved initiation of nocturnal advanced PAP (NIPPV) modality, RT-led respiratory care, medication reconciliation, appropriate oxygen therapy initiation, and patient education led to significant reduction in rehospitalization.

Coughlin et al; J Clin Sleep Med 2015 [In Press]

Diagnosis and Treatment of Sleep Disordered Breathing in Hospitalized Cardiac Patients: A Reduction in 30-Day Hospital Readmission Rates

Diagnosis and Treatment of Sleep Disordered Breathing in Hospitalized Cardiac Patients: A Reduction in 30-Day Hospital Readmission Rates


<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Users (n = 17)</th>
<th>Partial Users (n = 20)</th>
<th>Full Users (n = 19)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>63.1 ± 15.1</td>
<td>56.2 ± 14.1</td>
<td>63.0 ± 13.7</td>
<td>0.2501</td>
</tr>
<tr>
<td>Male</td>
<td>9/17 (52.9%)</td>
<td>14/20 (70.0%)</td>
<td>12/19 (63.2%)</td>
<td>0.5638</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>33.5 ± 5.5</td>
<td>36.1 ± 9.9</td>
<td>37.2 ± 9.1</td>
<td>0.4149</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>37.6 ± 19.7</td>
<td>35.5 ± 21.8</td>
<td>46.1 ± 19.1</td>
<td>0.2411</td>
</tr>
<tr>
<td>Heart failure</td>
<td>5/17 (29.4%)</td>
<td>8/20 (40.0%)</td>
<td>9/19 (47.4%)</td>
<td>0.5188</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>10/17 (58.8%)</td>
<td>8/20 (40.0%)</td>
<td>9/19 (47.4%)</td>
<td>0.5188</td>
</tr>
<tr>
<td>Diabetes</td>
<td>11/17 (64.7%)</td>
<td>7/20 (35.0%)</td>
<td>11/19 (57.9%)</td>
<td>0.1655</td>
</tr>
<tr>
<td>Stroke</td>
<td>4/17 (23.5%)</td>
<td>1/20 (5.0%)</td>
<td>7/19 (36.8%)</td>
<td>0.0437</td>
</tr>
<tr>
<td>AHI (events/h)</td>
<td>27.7 ± 21.0</td>
<td>31.4 ± 20.6</td>
<td>28.9 ± 26.6</td>
<td>0.8861</td>
</tr>
<tr>
<td>NYHA = 4</td>
<td>4/17 (23.5%)</td>
<td>9/20 (45.4%)</td>
<td>8/19 (42.1%)</td>
<td>0.4888</td>
</tr>
<tr>
<td>Total admission days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of patients clinically</td>
<td>48/17 (27.0%)</td>
<td>53/20 (26.5%)</td>
<td>54/19 (28.9%)</td>
<td>0.7190</td>
</tr>
<tr>
<td>30-day readmission/ED visit</td>
<td>5/17 (29.4%)</td>
<td>6/20 (30.0%)</td>
<td>0/19 (0.0%)</td>
<td>0.0246</td>
</tr>
</tbody>
</table>

Why are there different conclusions from these various studies?

“Borel and colleagues suggest that future studies should focus on specific COPD subgroups who have better likelihood of response to chronic noninvasive ventilation (NIV).”

“Overall, we agree with Borel and colleagues that based on their study it seems that chronic NIV is more effective in obese COPD patients; however, a randomized controlled trial in this specific subgroup is lacking.”
**NSQIP data: Obesity and Wound complications**

57% of patients with poor wound healing have OSA

**Wound healing: Let there be Oxygen!**

Endothelial Dysfunction in the Microcirculation of Patients with Obstructive Sleep Apnea

Microcircular vessel treated with anti-nitrotyrosine antibody
Pre-treatment Post-treatment


Peroxynitrite deposits in the microvascular walls of patients with OSA and control subjects.

Once harm is done even a fool understands it!
CPAP for treatment of post-operative intubation rate


Effect of CPAP on Secondary End-points

<table>
<thead>
<tr>
<th></th>
<th>Control  (n=104)</th>
<th>CPAP (n=105)</th>
<th>Difference of Means (95% CI)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU length of stay, mean (d)</td>
<td>2.6</td>
<td>1.4</td>
<td>-1.2 (-2.0 to -0.3)</td>
<td>.09</td>
</tr>
<tr>
<td>Median (IQR), d</td>
<td>1 (1-11)</td>
<td>1 (1-4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital length of stay, mean (SC), d</td>
<td>17 (15)</td>
<td>15 (13)</td>
<td>-2 (-5 to 2)</td>
<td>.10</td>
</tr>
<tr>
<td>Median (95% CI)</td>
<td>12 (7-47)</td>
<td>11 (6-35)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relative Risk (95% CI)

<table>
<thead>
<tr>
<th>Event</th>
<th>Control (n=104)</th>
<th>CPAP (n=105)</th>
<th>Difference of Means (95% CI)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia, No. (%)†</td>
<td>10 (10)</td>
<td>2 (2)</td>
<td>0.19 (0.04 to 0.38)</td>
<td>.02</td>
</tr>
<tr>
<td>Infection, No. (%)‡</td>
<td>11 (10)</td>
<td>3 (3)</td>
<td>0.27 (0.01 to 0.54)</td>
<td>.03</td>
</tr>
<tr>
<td>Sepsis, No. (%)§</td>
<td>9 (9)</td>
<td>2 (2)</td>
<td>0.22 (0.04 to 0.40)</td>
<td>.03</td>
</tr>
</tbody>
</table>

CPAP for treatment of post-operative respiratory complications after abdominal surgery

Study | Risk ratio (95% CI) | % Weight
--- | --- | ---
Anderes C (1979) | 0.57 (0.21, 1.55) | 6.0
Carlsson (1981) | 0.65 (0.60, 1.20) | 37.4
Lotz P (1984) | 3.00 (0.13, 68.57) | 0.6
Stock (1985) | 0.54 (0.21, 1.40) | 6.7
Ricksten (1986) | 0.19 (0.03, 1.40) | 1.6
Lidner (1987) | 0.20 (0.03, 1.54) | 1.5
Denshey (2001) | 0.67 (0.48, 0.93) | 41.1
Bohner (2002) | 0.42 (0.08, 2.14) | 2.3
Squadron V (2005) | 0.20 (0.04, 0.88) | 2.7
Overall | 0.66 (0.52, 0.85) | 100.0


Future Research Needs

“Future research should focus on adequate patient selection, ventilator settings, training and length of ventilation, as well as exacerbation frequency, admissions to hospital and survival.”

Do patients with COPD and OSA -- regardless of presence or absence of hypercapnia -- benefit from PAP therapy?

Can an existent clinical strategy that rapidly detects OSA and initiates PAP therapy reduce readmissions in patients with COPD?

In the US, there are currently no prospective multi-center randomized controlled trials that rapidly identify and treat OSA in hospitalized patients with COPD with the intent of reducing re-hospitalization.
Look wise, say nothing, and grunt.

Speech was given to conceal thought.

Sir William Osler
1849 - 1919

Thank you
Role of CPAP and Bilevel PAP in Reducing Hospital Readmissions

Sairam Parthasarathy, MD
Associate Professor of Medicine
Director, Center for Sleep Disorders
University of Arizona
Tucson, AZ
spartha1@email.arizona.edu

Conflict of Interest

<table>
<thead>
<tr>
<th>Affiliation/Interest</th>
<th>Name of Organization(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant/Research Support</td>
<td>Philips-Respironics, Inc. (research grant awarded to University of Arizona); Younes Sleep Technologies, Inc. (Research grant awarded to University of Arizona); Niveus Medical Inc. (Research grant to University of Arizona)</td>
</tr>
<tr>
<td>Consultant</td>
<td>None</td>
</tr>
<tr>
<td>Speakers’ Bureau</td>
<td>None</td>
</tr>
<tr>
<td>Major Stock Holder</td>
<td>None</td>
</tr>
<tr>
<td>Other financial support or material support</td>
<td>Honorarium for participation at the Key Opinion Leadership Summit (2014; for $2,000) Honorarium for contributing educational chapter to UpToDate, Inc. ($600 in last 12 months)</td>
</tr>
</tbody>
</table>
Sir William Osler 1849 - 1919

“To study the phenomenon of disease without books is to sail an uncharted sea...

………while to study books without patients is not to go to sea at all.”

Background

• COPD is the third leading cause of death in US
• 12.7 million adults have COPD
• Discharge rate of 23.2 per 100,000 population
• ~65% of COPD-related hospital discharges in ≥65 year olds with estimated cost of $50 billion/yr
• 30-day readmission is high 20-39%

Source American Lung Association
Background - 2

- Currently, Medicare penalizes hospitals for 30-day readmission of patients with COPD
- Patients with COPD and obesity are more likely to be readmitted
- Obese patients are more likely to suffer from OSA
- 29-40% of COPD patients have OSA

Feemster L & Au D, Am J Respir Crit Care Med 2014; 189:634-639
http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcutelnpatientPPS/Readmissions-Reduction-Program.html

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Variable Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oxygen count</td>
<td>Oxygen use; Oxygen saturations; oxygen in blood stream</td>
</tr>
<tr>
<td>2. Symptoms</td>
<td>Presence and severity of shortness of breath, cough, reduced exercise and activity tolerance</td>
</tr>
<tr>
<td>3. Stop smoking</td>
<td>Getting help to stop smoking</td>
</tr>
<tr>
<td>4. Reducing Risk for other coexisting disease/afflictions</td>
<td>Reducing the risk for cancers, heart problems, and other diseases associated with COPD</td>
</tr>
<tr>
<td>5. Prevent Hospitalizations</td>
<td>Prevent hospitalizations through better COPD management (unscheduled visits to ER, office, urgent care included)</td>
</tr>
<tr>
<td>6. Reduce Exacerbations</td>
<td>Influenza and pneumonia vaccinations; Emergency supply of prednisone and antibiotics for early use in illness onset</td>
</tr>
<tr>
<td>7. Improve physical activity</td>
<td>Pulmonary rehabilitation; Daily exercise</td>
</tr>
<tr>
<td>8. Advance directives and Transplant Candidacy</td>
<td>Discussing advance directives and end-of-life wishes and care. Assessing for lung transplant candidacy if eligible. Having difficult and important discussions about COPD condition</td>
</tr>
<tr>
<td>9. Improve sleep</td>
<td>Diagnose and treat insomnia and/or sleep apnea</td>
</tr>
<tr>
<td>10. Patient Education</td>
<td>Up-to-date information about COPD</td>
</tr>
<tr>
<td>11. Slowing the Loss of Lung Function</td>
<td>Prevent further damage to lungs by avoiding risks factors (i.e. smoking) and improving exercise tolerance</td>
</tr>
<tr>
<td>12. Improving General Health Status</td>
<td>Improving sense of well-being through nutrition, exercise, emotional, and spiritual support</td>
</tr>
<tr>
<td>13. Prevent &amp; Treat Complications</td>
<td>Preventing medication risks (i.e. prednisone effects on osteoporosis) and treating complications as they arise</td>
</tr>
<tr>
<td>14. Reduce Death</td>
<td>Reducing the chance of dying due to COPD</td>
</tr>
<tr>
<td>15. Treatment of Mental Comorbidities</td>
<td>Treatment of other mental health issues such as depression, and anxiety</td>
</tr>
<tr>
<td>16. Improve Access to Care</td>
<td>Facilitate fast access to doctors and nurses to enable prompt care in both non-urgent and urgent situation, enable communication between office and patient, provide for clinic availability for patient scheduling as needed</td>
</tr>
</tbody>
</table>
Knowledge Gaps

- Do patients with COPD have reduced 30-day readmission if they are on PAP therapy?
- How comparable are CPAP, bilevel PAP, and ventilator therapy in patients with COPD?
- Do patients with COPD and OSA -- regardless of presence or absence of hypercapnia -- benefit from PAP therapy?
- Can an existent clinical strategy that rapidly detects OSA and initiates PAP therapy reduce readmissions in patients with COPD?
Future Research Needs

“Future research should focus on adequate patient selection, ventilator settings, training and length of ventilation, as well as exacerbation frequency, admissions to hospital and survival.”

Research priorities generally focused on studies to evaluate different approaches to healthcare delivery (e.g., integrated healthcare strategies during transitions in care) rather than head-to-head comparisons of medications.

The impact of treatment of sleep-disordered breathing on major long-term clinical outcomes as a high priority.

Cochrane Database Syst Rev 2013; 6:CD002878
Am J Respir Crit Care Med 2013; 187:320-326
AHRQ No.12-EHC033-EF

Quality of Care for Patients Hospitalized for Acute Exacerbations of Chronic Obstructive Pulmonary Disease

N = 69,820

Lindenauer 2006
Randomized Studies Comparing Noninvasive Positive-Pressure Ventilation with Non-ventilatory Control

<table>
<thead>
<tr>
<th>Study (Reference)</th>
<th>Year</th>
<th>Patients</th>
<th>Type</th>
<th>Duration</th>
<th>NIV Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus et al. (108)</td>
<td>1996</td>
<td>9</td>
<td>Nasal, pressure support</td>
<td>4 h once</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Barbe et al. (109)</td>
<td>1996</td>
<td>10</td>
<td>Nasal, bilevel positive airway pressure</td>
<td>3 h twice per day</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Bell et al. (110)</td>
<td>1995</td>
<td>30</td>
<td>Nasal, volume cycled</td>
<td>6 h/d</td>
<td>0/30 (0)</td>
<td>2/30 (0)</td>
</tr>
<tr>
<td>Bouchard et al. (111)</td>
<td>1995</td>
<td>42</td>
<td>Face mask, pressure support</td>
<td>6 h/d</td>
<td>11/43 (26%)</td>
<td>31/42 (74%)</td>
</tr>
<tr>
<td>Kramer et al. (112)</td>
<td>1995</td>
<td>11</td>
<td>Nasal, bilevel positive airway pressure</td>
<td>≥8 h/d</td>
<td>1/11 (9%)</td>
<td>8/12 (67%)</td>
</tr>
</tbody>
</table>

* NPPV = noninvasive positive-pressure ventilation; NR = not reported.
† Blood gas improvement was defined differently in different studies. The results reported here are based on the definitions used in each study.
‡ Statistically significant within-group improvement (P < 0.05).
§ Statistical significance for within-group improvement was not reported.


Survival in patients with COPD and OSA

![Survival Graph](image)


<table>
<thead>
<tr>
<th>No at risk</th>
<th>COPD</th>
<th>Overlap with CPAP</th>
<th>Overlap without CPAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>210</td>
<td>203</td>
<td>196</td>
</tr>
<tr>
<td>Overlap with CPAP</td>
<td>228</td>
<td>223</td>
<td>215</td>
</tr>
<tr>
<td>Overlap without CPAP</td>
<td>213</td>
<td>204</td>
<td>186</td>
</tr>
</tbody>
</table>

P < 0.001
Severe Exacerbation-free Survival in patients with COPD and OSA


NIPPV Reduces Mortality in Severe Stable Hypercapnic COPD

Selection
PaCO₂ ≥ 52 mmHg
Ambulatory COPD with no recent exacerbation

Ineligible
BMI > 35 kg/m²

Goal of therapy
12 Months
PaCO₂ < 48 mmHg

Mean Rx
MIP = 21.6 cmH₂O
MEP = 4.8 cmH₂O
Rate = 16 bpm

Home noninvasive ventilation use following acute hypercapnic respiratory failure in COPD


Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure

Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure

Nocturnal noninvasive positive pressure ventilation in stable COPD: A systematic review and individual patient data meta-analysis

Struik et al; Respiratory Medicine (2014) 108, 329e337

Table 1  Characteristics of included studies.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Study design (compared to treatment)</th>
<th>IPWP/EPAP</th>
<th>Study population</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casona (2000)</td>
<td>Parallel group (LTOT)</td>
<td>12/4</td>
<td>52 randomised,</td>
<td>Blood gases, lung function, Pmax/PEmax, dyspnoea after 3 months,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>36 completers,</td>
<td>Exacerbation rate, hospital admissions, intubations and mortality</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 51 mmtg,</td>
<td>after 3 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 8.8 L</td>
<td></td>
</tr>
<tr>
<td>Cline (2002)</td>
<td>Parallel-group (sham)</td>
<td>14.4/3.8</td>
<td>90 randomised,</td>
<td>Blood gases, 6 MWD, lung function, Pmax/PEmax and sleep study</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>78 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 56 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.75 L</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 52 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.68 L</td>
<td></td>
</tr>
<tr>
<td>Meecham Jones</td>
<td>Cross-over (LTOT)</td>
<td>18/2</td>
<td>18 randomised,</td>
<td>Blood gases, 6 MWD, lung function, sleep study, dyspnoea</td>
</tr>
<tr>
<td>(1995)</td>
<td></td>
<td></td>
<td>14 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 56 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.84 L</td>
<td></td>
</tr>
<tr>
<td>Sin (2007)</td>
<td>Parallel-group (sham)</td>
<td>20/4</td>
<td>23 randomised,</td>
<td>Blood gases, HRIV, lung function, sleep study, dyspnoea</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 43 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.88 L</td>
<td></td>
</tr>
<tr>
<td>Strumpf (1991)</td>
<td>Cross-over (standard care)</td>
<td>15/2</td>
<td>19 randomised,</td>
<td>Blood gases, HRIV, lung function, sleep study</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 46 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.54 L</td>
<td></td>
</tr>
<tr>
<td>Long term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cline (2002)</td>
<td>Parallel-group (LTOT)</td>
<td>14.4/3.9</td>
<td>90 randomised,</td>
<td>Blood gases, 6 MWD, HRQ, lung function, sleep study, mortality</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>57 completers,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 56 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.75 L</td>
<td></td>
</tr>
<tr>
<td>McEvoy (2009)</td>
<td>Parallel-group (LTOT)</td>
<td>12.8/5.1</td>
<td>144 randomised,</td>
<td>Blood gases, HRQ, lung function, sleep study (only in NIPPV groups),</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>81 completers,</td>
<td>hospitalisation rates, survival</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaCO₂, 54 mm Hg,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PaO₂, 0.65 L</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSION: At present, there is insufficient evidence to support the application of routine NIPPV in patients with stable COPD. However, higher IPAP levels, better compliance and higher baseline PaCO\(_2\) seem to improve PaCO\(_2\).

Struik et al; Respiratory Medicine (2014) 108, 329e337

Nocturnal-NIPPV at home for at least three months in hypercapnic patients with stable COPD had no consistent clinically or statistically significant effect on gas exchange, exercise tolerance, HRQoL, lung function, respiratory muscle strength or sleep efficiency.

Cochrane Database Syst Rev 2013; 6:CD002878
Thorax. 2014; 69(9): 826-34
Retrospective assessment of a Multi-faceted program

A retrospective study of a quality improvement (QI) program performed at a single center whose multifaceted intervention included:

(a) nocturnal administration of advanced positive airway pressure (PAP) modality (or noninvasive positive pressure ventilation [NIPPV])
(b) Education by respiratory therapist (RT),
(c) medication reconciliation by a pharmacist,
(d) adequate provision of oxygen,
(e) and ongoing RT-led care including home-visits.

Coughlin et al; J Clin Sleep Med 2015 [In Press]

Retrospective Assessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease

N = 397

Proportion of patients

Admissions

Before
After

Coughlin et al; J Clin Sleep Med 2015 [In Press]
Hospitalization or death
Unadjusted Odds Ratio

* P < 0.05; †P < 0.10; †Compared to men

Increased risk

Decreased risk

Hospitalization or death
Adjusted Odds Ratio

Coughlin et al; J Clin Sleep Med 2015 [In Press]
Retrospective assessment of a Multi-faceted program

In a retrospective cohort study of a QI initiative undertaken at a single center, we have observed that a multifaceted intervention that involved initiation of nocturnal advanced PAP (NIPPV) modality, RT-led respiratory care, medication reconciliation, appropriate oxygen therapy initiation, and patient education led to significant reduction in rehospitalization.

Coughlin et al; J Clin Sleep Med 2015 [In Press]

Diagnosis and Treatment of Sleep Disordered Breathing in Hospitalized Cardiac Patients: A Reduction in 30-Day Hospital Readmission Rates

Diagnosis and Treatment of Sleep Disordered Breathing in Hospitalized Cardiac Patients: A Reduction in 30-Day Hospital Readmission Rates


<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Users (n = 17)</th>
<th>Partial Users (n = 20)</th>
<th>Full Users (n = 19)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>(17) 63.1 ± 15.1</td>
<td>(20) 56.2 ± 14.1</td>
<td>(19) 63.0 ± 13.7</td>
<td>0.2501</td>
</tr>
<tr>
<td>Male</td>
<td>(9) 52.9%</td>
<td>(14) 70.0%</td>
<td>(12) 63.2%</td>
<td>0.5638</td>
</tr>
<tr>
<td>Body mass index</td>
<td>(17) 33.5 ± 5.5</td>
<td>(20) 36.1 ± 9.9</td>
<td>(19) 37.2 ± 9.1</td>
<td>0.4149</td>
</tr>
<tr>
<td>LVEF%</td>
<td>(16) 37.6 ± 19.7</td>
<td>(20) 35.5 ± 21.8</td>
<td>(19) 46.1 ± 19.1</td>
<td>0.2411</td>
</tr>
<tr>
<td>Heart failure</td>
<td>(15) 89.2%</td>
<td>(18) 90.0%</td>
<td>(15) 84.2%</td>
<td>0.8657</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>(10) 58.8%</td>
<td>(8) 40.0%</td>
<td>(9) 47.4%</td>
<td>0.5188</td>
</tr>
<tr>
<td>Hypertension</td>
<td>(17) 100.0%</td>
<td>(17) 85.0%</td>
<td>(15) 84.2%</td>
<td>0.2575</td>
</tr>
<tr>
<td>Diabetes</td>
<td>(11) 94.7%</td>
<td>(7) 35.0%</td>
<td>(11) 57.9%</td>
<td>0.1655</td>
</tr>
<tr>
<td>Stroke</td>
<td>(4) 23.5%</td>
<td>(1) 5.0%</td>
<td>(7) 36.8%</td>
<td>0.0437</td>
</tr>
<tr>
<td>AHFI</td>
<td>(17) 27.7 ± 21.0</td>
<td>(20) 31.4 ± 20.6</td>
<td>(19) 28.9 ± 26.6</td>
<td>0.8821</td>
</tr>
<tr>
<td>NYHA ≥ 4</td>
<td>(4) 28.6%</td>
<td>(9) 47.4%</td>
<td>(8) 47.1%</td>
<td>0.4868</td>
</tr>
<tr>
<td>Total admission days</td>
<td>(17) 11.2 ± 6.7</td>
<td>(20) 14.9 ± 7.8</td>
<td>(19) 10.7 ± 7.1</td>
<td>0.3314</td>
</tr>
<tr>
<td>% of visits complete reliev</td>
<td>(17) 10.7 ± 7.0</td>
<td>(20) 33.4 ± 15.7</td>
<td>(19) 46.9 ± 23.0</td>
<td>0.3140</td>
</tr>
<tr>
<td>30 day readmission/ED visit</td>
<td>(5) 29.4%</td>
<td>(6) 30.0%</td>
<td>(3) 0.0%</td>
<td>0.0246</td>
</tr>
</tbody>
</table>

Why are there different conclusions from these various studies?

“Borel and colleagues suggest that future studies should focus on specific COPD subgroups who have better likelihood of response to chronic noninvasive ventilation (NIV).”

“Overall, we agree with Borel and colleagues that based on their study it seems that chronic NIV is more effective in obese COPD patients; however, a randomized controlled trial in this specific subgroup is lacking.”

Struijk & Wijkstra; Thorax 2014;0:1. doi:10.1136/thoraxjnl-2014-206066
NSQIP data: Obesity and Wound complications

57% of patients with poor wound healing have OSA

Wound healing: Let there be Oxygen!

Endothelial Dysfunction in the Microcirculation of Patients with Obstructive Sleep Apnea

Microcirculatory vessel treated with anti-nitrotyrosine antibody

Pre-treatment

Post-treatment


Peroxy nitrite deposits in the microvascular walls of patients with OSA and control subjects.

Once harm is done even a fool understands it!

CPAP for treatment of post-operative intubation rate


Effect of CPAP on Secondary End-points

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 104)</th>
<th>CPAP (n = 105)</th>
<th>Difference of Means (95% CI)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU length of stay, mean, d</td>
<td>2.6</td>
<td>1.4</td>
<td>-1.2 (-2.0 to -0.3)</td>
<td>.09</td>
</tr>
<tr>
<td>Median (95% CI), d</td>
<td>1 (1-11)</td>
<td>1 (1-4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital length of stay, mean (SD), d</td>
<td>17 (15)</td>
<td>15 (13)</td>
<td>-2 (-5 to 2)</td>
<td>.10</td>
</tr>
<tr>
<td>Median (95% CI)</td>
<td>12 (7-47)</td>
<td>11 (6-35)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Future Research Needs

“Future research should focus on adequate patient selection, ventilator settings, training and length of ventilation, as well as exacerbation frequency, admissions to hospital and survival.”

Do patients with COPD and OSA -- regardless of presence or absence of hypercapnia -- benefit from PAP therapy?

Can an existent clinical strategy that rapidly detects OSA and initiates PAP therapy reduce readmissions in patients with COPD?

In the US, there are currently no prospective multi-center randomized controlled trials that rapidly identify and treat OSA in hospitalized patients with COPD with the intent of reducing re-hospitalization.
Look wise, say nothing, and grunt.

Speech was given to conceal thought.

Sir William Osler
1849 - 1919

Thank you