Diagnosis & Treatment of Obstructive Sleep Apnea in the Hospitalized Patient

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No Conflict of Interest or Disclosure to make
Patient

58 year old woman with HTN, CKD III, morbid obesity, presumed Obstructive Sleep Apnea (OSA) and hypothyroidism admitted to CVMC for community acquired pneumonia, transferred after a PEA arrest.

Extubated upon arrival, CT-angio & LE Dopplers negative. Started on CPAP but did not tolerate it. Transferred to the Floor.

PEA Arrest on the Floor, intubated x 3 days. Nuclear stress negative. Echo EF 55%, no WMA.

Hospital Team suspected untreated OSA was the main problem.
Very little published data about addressing Obstructive Sleep Apnea in the hospitalized patient. There are no guidelines.

What patients should we be concerned about?  
How and when do we diagnose?  
What are the PAP modalities available for treatment?  
How do we monitor treatment response in the hospital?  
How do we transfer care to the outpatient?
Epidemiology of Sleep Apnea

2013 prevalence estimates of OSA in USA (AHI ≥ 15)

<table>
<thead>
<tr>
<th></th>
<th>1988-1994</th>
<th>2013</th>
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<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(30-49 y)</td>
<td>6%</td>
<td>10%</td>
</tr>
<tr>
<td>(50-70 y)</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(30-49 y)</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>(50-70 y)</td>
<td>7%</td>
<td>9%</td>
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</table>

OSA is highly prevalent!


SDB (OSA, CSA) in the Hospitalized Patient Population

? Total
60-96% of stroke patients
66% acute MI patient
76% CHF patients
Effect of Obstructive Sleep Apnea

Obstructive Sleep Apnea

Hypoxemia
Hypercapnea
Large intra-thoracic pressure swings
Increased sympathetic discharge

Complicating Hospital Course

Sleep Fragmentation
Circadian Disruption
Sleep Restriction

Worse Outcome
Longer hospital stay
Cardiopulmonary morbidity
Delirium
Mortality

Mortality
Which patients would benefit from immediate diagnosis and treatment of Obstructive Sleep Apnea (OSA), to hasten recovery and prevent re-hospitalization?

Chronic Respiratory Failure
- Morbidly obese patients (Obesity Hypoventilation & OSA)
- “Overlap Syndrome” (COPD & OSA)
- Obvious apneas during sleep or pronounced cyclical desaturation

Respiratory Arrest During Sleep

Congestive Heart Failure
Evaluation of OSA in the Inpatient Setting

Patient’s Physician

Pulmonary Consult Triage

Diagnosis & treatment must occur prior to discharge

OSA likely, diagnosis and treatment is not necessary for discharge, but diagnosis and treatment urgent

Order “Sleep Consult” in Discharge Orders & write “URGENT” OR Order “Polysomnogram” in Discharge Orders

OSA likely, diagnosis & treatment not urgent (can wait 2-3 months)

Order a “Sleep Consult” in Discharge Orders OR relay concern to the PCP
Methods of Diagnosis

Polysomnograms
  - Diagnostic Polysomnogram
  - Split Night Polysomnogram

Home/Portable Sleep Apnea Tests

Acceptable methods of diagnostic testing to qualify a patient for treatment with PAP
Methods of Diagnosis

Polysomnograms

• Sleep Center does not have nursing available & there is not same day availability
• At the Patient Bedside - Takes a lot of resources (on-call Sleep Technologist, large room, portable equipment)
• Financially unviable – no reimbursement
Diagnostic Polysomnogram

5 minutes

AHI = Apnea Hypopnea Index
Number of Apneas and Hypopneas per hour of sleep time
Methods of Diagnosis

Home/Portable Sleep Apnea Tests

- Unattended tests – dislodge/artifact
- Reduced sensitivity for diagnosis
- Not reimbursed, but they are relatively inexpensive to do
Appropriate alternative to PSG for patients with a high pre-test probability of OSA

Not Recommended in Patients with significant co-morbidities:
* Chronic Respiratory Failure
* Moderate to Severe Pulmonary Disease
* CHF
* Neuromuscular Disease
* Central Sleep Apnea

But ..... 
"May be used in the event that Polysomnography is not possible due to safety, immobility or critical illness"

A negative OCST, should be followed up with a PSG b/c of a high false negative rate in high risk patients.
Methods of Diagnosis

Home/Portable Sleep Apnea Tests

REI = Respiratory Event Index

REI is the term used for apnea-hypopnea-index (AHI) for Portable Studies

REI = Number of apneas and hypopneas per hour of monitoring time
Methods of Diagnosis

Nocturnal Oximetry – NO!
Not sufficient to make a diagnosis or qualify for treatment
Poor sensitivity, but can be helpful to prioritize
Inexpensive
Process at UVM Medical Center

Primary Physician

Pulmonary Consult – Triages

Portable Sleep Apnea Test

- Sleep Technologist applies the monitoring equipment in the evening and leaves
- Nursing re-applies sensors if they dislodge and monitors the patient for problems
- Sleep Technologist retrieves the equipment then next morning to download data
Our Patient’s Portable Sleep Apnea Test

Obstructive apneas causing deep desaturations despite 5 LPM O2. Respiratory Event Index (REI) = 6

3 minute epoch - Patient on 5 LPM O2
How use of supplemental oxygen causes an underestimation of the degree of OSA

3 minute epoch - Patient on 5 LPM O2
Diagnosis: Obstructive Sleep Apnea

The Portable Sleep Apnea Test (REI=6) qualifies the patient for CPAP

The patient has been tried on CPAP and documented to be intolerant of it due to claustrophobia
Starting the Patient On PAP in Hospital

Most institutions do not have the capacity to do attended PAP Titrations on hospitalized patients to determine mask, PAP unit and settings and supplemental oxygen needs.

Each institution has their own protocol for starting a patient on PAP.

Team Approach:
• Physician
• Respiratory Therapist
• Nursing
• Discharge Planning
• Patient

Cooperation and communication is paramount.
We want the patient to be comfortable and able to sleep on PAP!

**Challenge**
- Patient is not at baseline
- Masks are suboptimal
- Monitoring is not available to help guide treatment
- Estimating settings
Mask Fitting is Critical

Humidification helps improve comfort
Starting a Patient on PAP in Hospital for OSA

Respironics System One AutoBiPAP

Modes available:
CPAP, AutoCPAP, BiPAP, AutoBiPAP

There is no back up rate capability

Respironics DreamStation

ResMed AirSense S10
CPAP & BiPAP Modes

CPAP=10 with ramp

BiPAP 15/10 with ramp

IPAP = 15
EPAP = 10
(PS = 5)
AutoCPAP Mode

Scripted as:  AutoCPAP min 5, max 15  OR  AutoCPAP 5-15

CPAP Pressure varies Across the Night

PAP Pressure is increased based on the machine algorithm that identifies obstructive breathing as determined by airflow & snoring
AutoBiPAP Algorithm

Settings:
EPAP minimum ___ 4
IPAP maximum ___ 25

PS minimum ---- 2
PS maximum ---- 8

AutoTitrate BiPAP algorithm is designed to treat OSA, and does NOT necessarily guarantee ventilation, especially if the physician does not specify a PS minimum.
Caveats regarding using AutoModes

The Machine Algorithm determining PAP pressure increase & decrease is based on upper airway obstructive breathing based on flow limitation & snoring. The algorithms are proprietary.

Machine algorithms don’t work particularly well:
- s/p UPPP surgery patients or non-snorers
- central apneas or cheyne stokes breathing
- using a vented mask with vented tubing
- they are NOT designed to optimize ventilatory support

Use cautiously, in patients with comorbidities of:
- COPD, Hypoventilation Syndromes, Central Sleep Apnea, CHF
Our patient was placed on AutoBiPAP:

EPAPmin 12, IPAPmax 25
no specified PS – so the machine default of PSmin 0, PSmax 8 was used

She didn’t tolerate it
mask leaked
felt suffocated
Obtaining PAP Information at the Bedside

Quick way to check if the mask & settings are working for the patient

In our patient:
Therapy hours: 3.6 hours
Leak was 86.3
Machine-AHI 11.4
Obtaining Data from the PAP Units

Other:
- Attached Modems
- Built in Wireless Cellular Communication
Machine Download confirms the machine settings

<table>
<thead>
<tr>
<th>Device Settings as of 10/31/2014</th>
</tr>
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<tbody>
<tr>
<td><strong>Device Mode</strong></td>
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<tr>
<td><strong>Device Settings</strong></td>
</tr>
<tr>
<td><strong>Parameter</strong></td>
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<tr>
<td>Max IPAP</td>
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<td>Min EPAP</td>
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<td>View Optional Screens</td>
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<td>Ramp Time</td>
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<tr>
<td>Ramp Start Pressure</td>
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<tr>
<td>Mask Alert</td>
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Machine Download revealing treatment efficacy

Daily Details
10/31/2014 9:26 PM - 11/1/2014 3:03 AM

Mode: Auto Bi-Level with Bi-Flex

Pressure (cmH2O)
- IPAP
- EPAP
- Max IPAP Setting
- Min EPAP Setting

90% IPAP Pressure: 12.3
90% EPAP Pressure: 12.2

Sleep Therapy Flags

Indices
- 0.0 % of Night in PB
- CA: 0.0
- OA: 0.9
- H: 10.5
- FL: 0.3
- VS: 1.8
- RE: 0.6
- AHI: 11.4

FL - Flow Limitation, VS - Vibratory Snore, PB - Periodic Breathing, CA - Clear Airway Apnea, RE - RERA, H - Hypopnea, OA - Obstructed Airway Apnea, AHI - Apnea/Hypopnea Index

Total Leak (LPM)
- Normal Mask Fit
- Breathing not detected
- Large Leak (LL)
- Total Leak

Min in Large Leak: 38.0 mins.
% of Night in Large Leak: 18.9 % of Night
Average Leak: 86.3
AutoBiPAP Settings were changed to EPAPmin 8, IPAPmax 20, PSmin/max 6
AutoBiPAP Download confirmed machine settings

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<th>Value</th>
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<tr>
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<td>View Optional Screens</td>
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<td>Ramp</td>
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</table>
AutoBiPAP Download revealing treatment efficacy

Daily Details
11/5/2014 11:54 PM

Pressure (cmH2O)

- DPAP
- EPAP
- Max IPAP Setting
- Min EPAP Setting

Mode: Auto Bi-Level with Bi-Flex

90% IPAP Pressure: 15.2
90% EPAP Pressure: 9.2

Indices
- % of Night in PB: 0.0%
- CA: 0.3
- OA: 1.3
- H: 0.3
- FL: 0.4
- VS: 3.2
- RE: 0.4
- AHI: 1.9

Total Leak (LPM)

- Normal Mask Fit
- Breathing not detected
- Large Leak
- Total Leak

Min in Large Leak: 1.0 mins.
% of Night in Large Leak: 0.2%
Average Leak: 21.7
Discharge Planning
Getting the Patient Equipment

For CPAP & BiPAP:
Face to Face Physician Consult/Note
Diagnosis of Obstructive Sleep Apnea
with documentation by PSG or Portable Sleep Apnea Testing
Physician Order for PAP with mask & settings (& supplemental O2) specified

For BiPAP, must also include:
Documentation of patient intolerance to CPAP (state reason) and/or
documentation of failure of CPAP to normalize breathing
Our Patient

Discharged on AutoBiPAP EPAPmin 8, IPAPmax 20, PSmin/max 6 and 5 LPM O2 with scheduled Follow up

Outpatient Sleep Clinic Follow-up:
Doing well. Compliant by report.
Machine download: Compliant on PAP (7.5 hours/night). Machine-AHI 1.

PAP Titration PSG: Confirmation of AutoBiPAP Settings
No O2 necessary. O2 was discontinued

She is followed by Sleep Physician
Main Points

There are no clear guidelines or practice parameters regarding the diagnosis and treatment of OSA in the hospitalized patient.

Portable Sleep Apnea Testing can be an effective method for diagnosing Obstructive Sleep Apnea in hospitalized patients when diagnosis and treatment is necessary prior to discharge.

When Initiating PAP treatment for OSA:
- Listen to the patient and educate
- Try different masks & settings to determine comfort when awake
- Understand the different PAP modes
- Know the pitfalls of AutoCPAP & AutoBiPAP
- Utilize the Machine Data to help guide with treatment
- Document intolerance and/or failure of CPAP
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