In-Hospital Sleep Program: Challenges and Success Stories

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Disclosures

• I have no disclosures
Outline

- Why consider sleep testing among inpatients?
- Inpatient populations at high risk for OSA
- Benefits of PAP initiation in inpatients
- Testing options for OSA in inpatients

Why consider sleep testing for inpatients?

- OSA is underdiagnosed overall and probably especially prevalent in the multi-morbid inpatient population
- OSA in hospitalized patients has been associated with adverse outcomes
- OSA patients use more physician services and are admitted to hospitals at higher rates compared with individuals without OSA

OSA is highly prevalent in hospitalized patients

Figure 2—Percentage of hospitalized patients screened at high risk for obstructive sleep apnea (total n = 424).

Shear et al. JCSM. 2014; 10(10): 1061.
Pts at high risk for OSA have longer length of stay

![Mean Length of Stay graph]


PAP noncompliance is associated with higher rapid response rates

![RRT rate per 1000 admissions graph]

OSA nonadherence is associated with higher 30-day hospital readmission rate

- Retrospective study of VA pts
- 30-day all-cause readmission rates higher in those nonadherent with CPAP, aOR=3.5
- 30-day cardiovascular-cause readmission rate also significantly higher in the nonadherent group, aOR=2.31


To (inpatient) test or not to test?

Pros
- Expedite Dx & Tx
- Convenience – a captive audience
- Access to hospital resources for complex patients (eg. Hoyer lifts, nursing)

Cons
Patients undergoing laboratory PSG are increasingly medically complex

Pros
- Early recognition, expedited Tx
- Convenience – a captive audience
- Access to hospital resources for complex patients (eg. Hoyer lifts, nursing)
- Opportunity for inpatient education
- Reduce loss to follow-up

Cons
- “Another test, doc?!?”
- Disturbed sleep is common (potential for inconclusive results)
- Many pts to require repeat testing after clinical condition stabilizes
- Not reimbursable (but potential for capturing future outpt charges)

To (inpatient) test or not to test?
Whom should we test?

- Standard screening questionnaires (e.g., Berlin, STOP-Bang) have not been validated in inpatients
- Consider screening populations with high OSA prevalence:
  - Post-stroke
  - Cardiac patients (heart failure, afib)
  - Perioperative
Post-Stroke Patients

- OSA an independent risk factor for ischemic and hemorrhagic stroke
- High prevalence of OSA after CVA/TIA
  - AHI > 5 in 72%; AHI > 20 in 38%
- Obstructive > central sleep apnea
- Presence of OSA predicts poor functional outcome, longer hospitalization/rehab stay, higher mortality and increases risk for recurrent stroke


Management of OSA after Stroke

- All patients with TIA and stroke should be assessed for possible sleep apnea*
- Mixed evidence re: whether PAP improves stroke severity scores, but starting earlier may be better
- Acute stroke patients tend to have more trouble using CPAP if they have dementia, delirium, aphasia, or severe motor impairment

* American Heart Association and American Stroke Association recommendations
  Bravata et al., Sleep. 2011; 34(9):1271.
**CPAP may improve functional outcomes after stroke rehab**

- Active vs. sham CPAP x 18 months post-stroke
- Average usage 3.7 hrs/night (50% adherent by CMS)
- Change in Functional Independence Measure (disability) *favored CPAP* but not statistically significant

<table>
<thead>
<tr>
<th>On-treatment FIM change</th>
<th>Active CPAP (n = 13)</th>
<th>Sham CPAP (n = 17)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>32 (21–45)</td>
<td>26 (20–32)</td>
<td>0.11</td>
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<tr>
<td>Cognitive</td>
<td>6 (3–6)</td>
<td>2 (2–5)</td>
<td>0.06</td>
</tr>
<tr>
<td>Motor</td>
<td>29 (18–32)</td>
<td>23 (20–26)</td>
<td>0.17</td>
</tr>
</tbody>
</table>


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**Sleep Apnea & Heart Failure**

- HF the most common cause of hospital admissions and readmissions in the US
- ~75% of pts admitted for acute decompensated heart failure have SDB (central and obstructive)
- Pts diagnosed with OSA during an admission for CHF had higher rates of readmission and mortality at 14 mos (hazard ratio 2.9)

• >100 cardiac inpatients admitted with heart failure, arrhythmias, MI and reporting OSA Sx
• Inpatient sleep testing → 80% had sleep apnea

Sleep Apnea Dx/Tx may reduce heart failure readmissions

- None of the patients with regular PAP usage had ED visits or readmissions within 30 days of discharge
- Readmission rates 30% in pts with non-use/partial-use (p = 0.025)

Heart failure readmissions are lower at 6-months in PAP adherent pts

- 70 patients diagnosed with SDB after discharge, 53% compliant with PAP
- Compliant pts had a significant reduction in readmissions over 6 months (p <0.0001)


OSA & Afib

- Most studies show a strong association between afib and OSA, independent of shared risk factors
- Growing data suggest OSA is a risk factor for recurrent afib after cardioversion or ablation
- Treatment of OSA may reduce the risk of recurrent afib

Mehra R. *Chest*. 2018 Nov;154(5):1008-1010
OSA & Surgery

- OSA pts are often undiagnosed at time of surgery
- Many studies show worse perioperative outcomes in pts with OSA
  - pulmonary complications, oxygen desaturation events, difficult intubation, cardiac complications, ICU transfer
- Professional society guidelines recommend incorporating an OSA screening tool in the preoperative assessment of patients preparing for any surgery


Some studies show CPAP use for OSA pts is associated with ↓ post-op pulmonary complications +/- LOS

Recent meta-analysis failed to show a difference in post-op adverse events, but possibly underpowered

Options for OSA Testing in Inpatients

Testing for OSA in inpatients

- Portable/“home”/ambulatory sleep apnea testing
- Overnight oximetry
- Full diagnostic polysomnography
- Titration studies not practically feasible
Portable sleep testing equipment

Many inpatients are not traditional candidates for portable monitoring

- Severe cardiorespiratory disease
- Potential respiratory muscle weakness (e.g., neuromuscular disease)
- Awake hypoventilation or suspected sleep-related hypoventilation
- Chronic opioid use
Sawtooth pattern on pulse oximetry in OSA

Oximetry may accurately identify post-stroke patients with OSA

ODI \geq 5 \text{ events/h rules in the presence of SDB (specificity 91.7\%, PPV 96.3\%)}$

ODI < 5 \text{ events/h rules out moderate to severe SDB (sensitivity 100\%, NPV 100\%)}$

High-resolution pulse oximetry as a testing option

- Prospective trial of 125 pts admitted with CHF
- Underwent simultaneous portable monitoring and high-resolution pulse oximetry → good agreement
- HRPO a simple and perhaps cost-effective screening tool for OSA


Practical Considerations for Inpatient Sleep Testing

- Development of institutional protocols & procedures
  - Patient selection
  - Who can order the studies
  - Equipment type
  - Study location
- Training of specialized RTs
- Handling inevitable interruptions
Practical Considerations for Inpatient Sleep Testing, cont.

• Study interpretation / timing
• DME communication
• Transition to outpatient sleep clinic
• Get the word out

Building your case for Inpatient Sleep Testing

• Consider hospital perspectives & incentives
• Potential to reduce financial penalties for early readmissions

CMS includes the following six condition/procedure-specific 30-day risk-standardized unplanned readmission measures in the program:
- Acute Myocardial Infarction (AMI)
- Chronic Obstructive Pulmonary Disease (COPD)
- Heart Failure (HF)
- Pneumonia
- Coronary Artery Bypass Graft (CABG) Surgery
- Elective Primary Total Hip Arthroplasty and/or Total Knee Arthroplasty (THA/TKA)

• Illustrate “big picture” plan inclusive of outpatient follow-up
Hospitalization: an educational opportunity for CPAP use?

Summary

- OSA is common and likely under-diagnosed among hospitalized patients
- Consider inpatient testing in high-risk populations
  - Post-stroke
  - Cardiac patients
  - Peri-operative
- Nocturnal oximetry or portable monitoring likely the most practical testing options for most institutions
Thank you!

Questions?

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