Management of Documented or Suspected Obstructive sleep apnea (OSA) in Patients Undergoing Non-Cardiac Surgery

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Disclosures

• No financial disclosures
• No discussion of “off label” use of drugs

OSA: Common, Increasing, and Underrecognized!

• Moderate OSA* ♂ 13% ♀ 6%
• Prevalence has increased over past 20 years
• Undiagnosed: 70%

*Apnea-hypopnea index (AHI) > 15
What are the consequences of OSA in the peri-op period?

Peri-op Complications Attributed to OSA: Initial Case Reports/Small Case Series

- Difficult intubation and extubation
- Large blood pressure fluctuations
- Profound desaturation → myocardial ischemia, arrhythmias
- Delirium
- Postobstructive pulmonary edema (breathing efforts against closed upper airway)
- Respiratory arrest
- Death
OSA Status and Complication Rates in Lower Extremity Joint Replacements

Peri-op Complications Attributed to OSA: Recent, Larger Series
- Complication rates 2-7x ↑ in OSA
- ↑ risk in OSA for:
  - Unplanned ICU transfers
  - Reintubation
  - Cardiac events (MI; arrest; dysrhythmias)
  - Aspiration pneumonia
  - Venous thromboembolism in ortho patients
  - Longer length of stay

Risk-Adjusted Rates of Postoperative Cardiopulmonary Complications for Treated and Untreated Obstructive Sleep Apnea Patients
- Odds Ratio for complications: 1.8
• What factors ↑ risk of post-op complications in OSA patients?

Factors that ↑ Post-op Risk in OSA

- Difficult airway control
- Hypoxemia
- Hypercapnia
- Intrathoracic pressure swings
- Arousals
- Associated comorbidities

Depressant effects of anesthetics/analgesics/sedatives
- Upper airway narrowing due to post-intubation edema, nasal packings, appliances, hematomas
- Forced supine positioning
- Intense REM rebound
- Temporary suspension of CPAP

• How should patients be screened for OSA?
Pre-op Considerations

- OSA is highly prevalent
- Most cases undiagnosed
- Potentially devastating complications if untreated

- History
- Physical exam
- Clinical screening tool to sieve out high risk pts

All pre-op evals should look for OSA!

Case

- 69 F
- DJD; awaiting knee arthroplasty.
- Husband: witnessing loud snoring, apneas nightly
- Patient: rare snort arousals; occasionally sleepy
- PMHx: Hypertension, hyperlipidemia, obesity
- BMI: 36 kg/m² BP: 152/92
- Mallampati IV
- Neck: 17"
- OSA suspected; Sleep evaluation broached
- Pt resistant. “I just want my knee fixed!”

Question

- Which of the following has the highest positive likelihood ratio* for OSA?

A. Snoring
B. Excessive daytime sleepiness
C. Witnessed apneas
D. Choking/gasping arousals from sleep

*Relative likelihood that a given feature would be expected in a patient with, as opposed to one without, OSA.
OSA Symptoms: Singularly Imprecise

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snoring</td>
<td>90</td>
<td>19</td>
<td>1.1</td>
<td>0.60</td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>50</td>
<td>61</td>
<td>1.3</td>
<td>0.81</td>
</tr>
<tr>
<td>Witness apneas</td>
<td>80</td>
<td>42</td>
<td>1.4</td>
<td>0.47</td>
</tr>
<tr>
<td>Choking/gasping</td>
<td>52</td>
<td>84</td>
<td>3.3</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Question

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- A. Snoring
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- C. Witnessed apneas
- D. Choking/gasping arousals from sleep

*Relative likelihood that a given feature would be expected in a patient with, as opposed to one without, OSA

Patients at high risk for OSA

- Hypertension
- Obesity (BMI > 35)
- Congestive heart failure
- Atrial fibrillation
- Type 2 diabetes mellitus
- Nocturnal dysrhythmias
- Stroke
- Pulmonary hypertension
OSA Signs: Singularly Imprecise

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>74 (66-81)</td>
<td>45 (34-56)</td>
<td>1.3</td>
<td>0.60 (0.51-0.70)</td>
</tr>
<tr>
<td>Mallampati (3-4)</td>
<td>65 (54-75)</td>
<td>60 (47-72)</td>
<td>1.6</td>
<td>0.60 (0.41-0.86)</td>
</tr>
<tr>
<td>Pharyngeal narrowing</td>
<td>67 (58-66)</td>
<td>53 (40-66)</td>
<td>1.4</td>
<td>0.63 (0.50-0.80)</td>
</tr>
</tbody>
</table>

Berlin Questionnaire for OSA: Category 1

1. Do you snore?  
   Yes (1)  
   No  
   Don’t know

2. Your snoring is:  
   Slightly louder than breathing  
   As loud as talking  
   Louder than talking (1)  
   Very loud, can be heard in other rooms (1)

3. How often do you snore?  
   Almost every day (1)  
   3-4 times per week (1)  
   1-2 times per week  
   1-2 times per month  
   Rarely

4. Has your snoring ever bothered other people?  
   Yes (1)  
   No  
   Don’t know

5. Has anyone noticed that you stop breathing during your sleep?  
   Almost every day  
   3-4 times per week (2)  
   1-2 times per week (2)  
   1-2 times per month  
   Rarely or never

Score: “+” if ≥ 2

Berlin Questionnaire for OSA: Category 2

6. How often do you feel tired or fatigued after your sleep?  
   Almost every day (1)  
   3-4 times per week (1)  
   1-2 times per week  
   1-2 times per month  
   Rarely or never

7. During your waking time, do you feel tired, fatigued, or not up to par?  
   Almost every day (1)  
   3-4 times per week (1)  
   1-2 times per week  
   1-2 times per month  
   Rarely or never

Score: “+” if ≥ 2

8. Have you ever nodded off or fallen asleep while driving a vehicle?  
   Yes (2)  
   No

Netzer N. Ann Intern Med 1999; 131:485
Berlin Questionnaire for OSA: Category 3 and Interpretation

10. Do you have high blood pressure?
Yes (1)
No

11. BMI
> 30 (1)
< 30

Score: “+” if either hypertension or obesity

“High risk” for OSA: ≥ 2 categories “+”
“Low risk” for OSA: < 2 categories “+”

Netzer N. Ann Intern Med 1999; 131:485

Berlin Questionnaire for OSA: Our Patient

1. Do you snore?
Yes (1)
No
Don’t know

2. Your snoring is:
Slightly louder than breathing
As loud as talking
Louder than talking (1)
Very loud—can be heard in other rooms (1)

3. How often do you snore?
Almost every day (1)
3-4 times per week (1)
1-2 times per week
1-2 times per month
Rarely or never

Score: “+” since ≥ 2

Netzer N. Ann Intern Med 1999; 131:485

Berlin Questionnaire for OSA: Our Patient

4. Has your snoring ever bothered other people?
Yes (1)
No
Don’t know

5. Has anyone noticed that you stop breathing during your sleep?
Almost every day (2)
3-4 times per week (2)
1-2 times per week (2)
1-2 times per month
Rarely or never

Score: “+” since ≥ 2

Netzer N. Ann Intern Med 1999; 131:485

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6. How often do you feel tired or fatigued after your sleep?
Almost every day (1)
3-4 times per week (1)
1-2 times per week
1-2 times per month
Rarely or never

7. During your waking time, do you feel tired, fatigued or not up to par?
Almost every day (1)
3-4 times per week (1)
1-2 times per week
1-2 times per month
Rarely or never

Score: “-” since < 2

Netzer N. Ann Intern Med 1999; 131:485

Berlin Questionnaire for OSA: Our Patient

8. Have you ever nodded off or fallen asleep while driving a vehicle?
Yes (2)
No

Score: “-” since < 2

Netzer N. Ann Intern Med 1999; 131:485
Berlin Questionnaire for OSA: Our Patient

10. Do you have high blood pressure?
   - Yes (1)
   - No

11. BMI
   - ≥ 30 (1)
   - < 30

Score: “+” since hypertension and obesity

“High risk” for OSA: ≥ 2 categories “+”

Netzer N. Ann Intern Med 1999; 131:485

STOP-Bang

Snoring: Do you snore loudly (heard through closed doors)?
   - YES (Y)
   - NO (N)

Tired: Do you often feel tired, fatigued, or sleepy during day?
   - YES (Y)
   - NO (N)

Observed: Has anyone observed you stop breathing?
   - YES (Y)
   - NO (N)

Pressure: Do you have or are you being treated for high blood pressure?
   - YES (Y)
   - NO (N)

BMI: > 35?
   - YES (Y)
   - NO (N)

Age: > 50?
   - YES (Y)
   - NO (N)

Neck circumference: > 40 cm?
   - YES (Y)
   - NO (N)

Gender: Male?
   - YES (Y)
   - NO (N)

“High OSA risk”: ≥ 5 questions “yes”
“Intermediate OSA risk”: 3-4 questions “yes”
“Low OSA risk”: < 3 questions “yes”

Chung F. Anesthesiology 2008; 108:812

Note: risk cut points 1 higher in obesity

For Moderate-Severe OSA (AHI > 15):

<table>
<thead>
<tr>
<th></th>
<th>Berlin</th>
<th>STOP-Bang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>79%</td>
<td>93%</td>
</tr>
<tr>
<td>Specificity</td>
<td>51%</td>
<td>43%</td>
</tr>
<tr>
<td>PPV</td>
<td>51%</td>
<td>52%</td>
</tr>
<tr>
<td>NPV</td>
<td>78%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Sensitivity favored at expense of specificity; “Low risk” patients may proceed to surgery with usual peri-op care

Chung F. Anesthesiology 2008; 108:822
<table>
<thead>
<tr>
<th>Neck Circ (CM)</th>
<th>Prediction of OSA - Sleep Apnea Clinical Score</th>
<th>Hypertensive</th>
<th>Not Hypertensive</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Historical Features*</td>
<td>None</td>
<td>One</td>
</tr>
<tr>
<td>&lt;30</td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>30-31</td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>32-33</td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
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<td>34-35</td>
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<td>2</td>
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<td>36-37</td>
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<td>2</td>
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<td>38-39</td>
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<td>40-41</td>
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<td>2</td>
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<td>42-43</td>
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<td>44-45</td>
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<td>3</td>
<td>2</td>
</tr>
<tr>
<td>46-47</td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>&gt;49</td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

*Historical features:
- Snoring ≥ 3 times/week
- Gasp/choke/snort ≥ 3 times/week

Prediction Formulas: Which is Best?

- No clinical model is recommended for use to predict severity of sleep apnea
  - STOP-Bang, SACS: predict post-op complications

- Screening tool decision lies with clinicians and their institutional experience
Pearls for Pre-op OSA Detection

- Seek bed partner input
  - Consider overnight oximetry if no collateral history

- History of difficult intubation predicts OSA and vice versa

- ↑ serum bicarb + BMI ≥ 30 → possible obesity hypoventilation
  - Approximately 10% of OSA patients

Obesity Hypoventilation Syndrome

- ↑ morbidity/mortality vs eucapnic OSA/obesity

Which patients with suspected OSA need sleep testing before surgery?
Question
• What would you advise in our patient?

A. Proceed to surgery
B. Screening overnight oximetry
C. Referral to Sleep for polysomnogram
D. Surgery now with empiric auto-CPAP post-op

Pre-op Sleep Testing vs Presumptive Treatment of "High Risk for OSA" Patients
• Case-by-case decision with all stakeholders
• Consider:
  • Urgency of surgery
  • Invasiveness of surgery
  • Type of anesthesia
  • Post-op opioid needs
  • Suspected severity of OSA
  • Co-morbidity burden
  • Likely use of PAP by Rx-naïve patient
Back to our Patient…

- Sleep evaluation advised:
  - Elective surgery
  - Strong suspicion for OSA (*oxi unlikely to change this*)
  - General anesthesia
  - Post-op IV opioids likely
  - Hypertension not tightly controlled

- Polysomnogram: severe OSA
  - AHI: 49 events/hr
  - Lowest SpO₂: 70%
  - % time SpO₂ < 90%: 18%

- If presumptive management: peri-op care should be same as for known mod-severe OSA

- If pre-op tested and OSA confirmed → CPAP
  - Face validity, yet impact on post-op complications not well defined
  - Optimal pre-op use unclear; suggest 1 week
  - Non-PAP options not well studied

- How about the pre-op assessment of patients with known OSA?
Pre op Evaluation: Known OSA

- ↑ OSA severity → ↑ risk

- Instruct to bring treatment modality to hospital!

- Referral to sleep center if:
  - Symptomatic despite CPAP
  - CPAP non-compliance
  - > 10% weight change since CPAP titration
  - No recent Sleep f/u
  - Reassessment of non-CPAP options

Are there guidelines for management of OSA in peri-op period?

Publications on Peri-op OSA Management

- Canadian Anesthesiologists’ Society
  - Can J Anesth 2010; 57:849

- Society for Ambulatory Anesthesia
  - Anesth Analg 2012; 115:1060

- ASA
  - Anesthesiology 2014; 120:268
• Inpatient or outpatient surgery?

Intra-op Considerations for Known or Suspected Mod-Severe OSA

• Avoid sedating pre-meds

• If no intubation:
  • Provide pt’s usual OSA treatment
  • If moderate sedation:
    • Administration by properly trained personnel
    • Continuous SpO2, CO2 monitoring

• If intubated:
  • ASA Difficult Airway Guideline
Extubation
- Airway resources immediately available
- Ensure sufficient patient wakefulness, cooperation
- Verify reversal of neuromuscular blockade
- Maximal head of bed elevation
- Prompt initiation of PAP

Which known or suspected OSA patients require closer monitoring?

Question
- Which of the following is the strongest predictor of complications from OSA for our patient after her discharge from the PACU?

A. High pre-op SACS score
B. Intubation difficulty for the procedure
C. Witnessed apneas in the PACU
2-Step Process for Identifying Patients at Risk for Post-op Complications from OSA

1. Calculate pre-op Sleep Apnea Clinical Score
2. Monitor for recurrent events in PACU

PACU Evaluation for OSA

<table>
<thead>
<tr>
<th>Bradypnea</th>
<th>AHI</th>
<th>RASS</th>
<th>Evaluation Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4 respirations/minute (3 episodes needed for year)</td>
<td>1 &lt;= 5</td>
<td>0-4</td>
<td>Initial 30 min. after intubation or PACU admit (whichever occurs later)</td>
</tr>
<tr>
<td>Apnea</td>
<td>&lt; 20 per hour (only 1 episode needed for year)</td>
<td></td>
<td>2nd 30 min. after initial eval. (60 min after extubation or PACU admit)</td>
</tr>
<tr>
<td>Discontinuation Rule: RSI &lt; 90° with nasal cannula (3 episodes needed for year)</td>
<td></td>
<td></td>
<td>3rd 30 min. after 2nd eval. (90 min after extubation or PACU admit)</td>
</tr>
<tr>
<td>Noninvasive respiratory</td>
<td>NAPS score &gt; 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RASS = Richmond Agitation-Sedation Scale
RPS = Richmond Pain Scale
PACU = Post-Anesthesia Care Unit

Recurrent events if any event occurs at more than one eval period (not necessary to be same event)
Question

• Which of the following is the strongest predictor of complications from OSA for our patient after her discharge from the PACU?

A. High pre-op SACS score
B. Intubation difficulty for the procedure
C. Witnessed apneas in the PACU

Post-op Setting for High-Risk Patients

• Monitored bed
  • Continuous pulse oximetry with local and remote monitoring via telemetry
  • Early nursing intervention possible
  • ICU
• Step-down unit
• Bed close to RN station on ward
How Long to Continue Oximetry Monitoring?

- Low opioid, sedative requirements
- Ad-lib positioning
- Adequate oxygenation
- Maintenance of clear mental status
- Satisfactory PAP resumption

In OSA, AHI highest on post-op night 3

Other Post-op Considerations

- Inconsistent post-op CPAP use in known OSA
  - Auto-CPAP may be an option
- Breakthrough snoring on PAP means obstruction occurring
- Caution with PCA
  - Monitoring must be in place
  - Consider eliminating basal infusion
- Regional, multimodality analgesia to minimize opioids
- Minimize sedative/hypnotics
- Lateral or semi up-right positioning preferred, if possible

Back to our Patient…

- Extubated in PACU; immediate CPAP initiation
- Post-op nausea → nasogastric tube
- You are called for desaturations during sleep despite CPAP
Post-op Desaturations Despite CPAP

• Inadequate pressure
  • Consider if breakthrough snoring
  • Empiric ↑ pressure; auto-CPAP; ↓ meds

• Interface issues due to tubes, packings
  • Full face mask

• Central sleep apnea from opioids
  • ↓ meds

• Other post-op pulmonary complications

---

• Does PAP improve post-op outcomes?

---

138 total knee or hip arthroplasty patients

• OSA stratification per SACS
  • Low risk (52): usual post-op care
  • High risk:
    • Usual post-op care (43)
    • Post-op APAP (43) (median use 3 hours/night)

• No differences on LOS, secondary endpoints

O'Gorman SM. Chest 2013; 144:72
• Putting it all together…

Modified from: Seet E. Can J Anesth 2010; 57:849

Pre-op patient
w/o known OSA

Hx, PE, OSA screening tool

Berlin STOP-Bang SACS Oximetry

High-risk of OSA

Low risk of OSA

High-risk of OSA

BMI > 35
CHF
HTN
Stroke
Arrhythmias
CAD
DM2
SpO₂ < 90
↑HCO₃

Low risk of OSA

Routine cares

Major elective surgery, post-op opioids, or major co-morbidities?

No
Proceed to surgery with peri-op OSA precautions

Yes
Consider pre-op sleep evaluation

Stakeholder discussion

CPAP
Avoid sedating pre-meds; ASA Difficult Airway Algorithm; regional blocks and multimodal analgesia; verify full reversal of NM blockade before extubation; look for recurrent PACU events; non supine posture for recovery; minimize opioids, hypnotics; caution with PCA.
Pre-op patient with known OSA

Moderate-severe OSA (AHI > 15; hypventilation)

Mild OSA (AHI 5-15; SpO2 > 94% RA)

Changes in OSA status?

No

Yes

Persistant symptoms
PAP non use
Weight change
Lost to Sleep
Assess non-PAP options

Routine cares

Don't ignore! Pt to bring OSA Rx to hospital; may need closer monitoring if PACU events

Peri-op Precautions for Known or Suspected Moderate-Severe OSA

• Hospital-based surgery for upper airway procedures, post-op opioids (IV) anticipated

• Prepare for difficult intubation

• Anesthesia: regional, short-acting GA agents

• Extubate only in safe location when patient awake, in non-supine position, and neuromuscular blockade reversed

• Analgesia: multimodality; minimize opioids

• Early reinitiation of PAP
Thank you for your attention

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