Perioperative Pulmonary Assessment

Obstructive Sleep Apnea, Pulmonary Hypertension, Pulmonary Emboli
Objectives

- Management of the patient with OSA.
  - Pre-operatively
  - Post-operatively
- Management of patients at high risk for OSA
  - Pre-operatively
  - Post-operatively
- Perioperative management of the patient with pulmonary hypertension.
- Recent data on Pulmonary Emboli
CASE #1

60 y/o obese man with a PMH of HTN and type 2 DM presents for preop evaluation before undergoing left knee replacement. He reports no cardiac or respiratory symptoms. He admits to daytime fatigue and waking his bed partner up with his snoring. His BMI is 42 kg/m² and his measured neck circumference is 45 cm.

Which of the following is the best perioperative management plan for this patient?

A) Delay surgery and refer to a sleep medicine physician
B) Proceed with surgery with no additional planning
C) Proceed with surgery with plan for continuous pulse oximetry monitoring
What is the prevalence of OSA?

- General U.S. Population: AHI > 15:
  * 8% in men
  * 3% in women

- Surgical Population
  * Higher than the general population
  * 70% of bariatric patients

- Increases with age
Do patients with OSA have higher postoperative risk of complications?

- 2012 Meta-analysis of pts with OSA (Kaw, et al)
  * 2–4 fold risk of any of the following:
    # Respiratory complications
    # Postoperative cardiac events
    # ICU transfer
Preoperative Screening for OSA

- Who to screen?

- Screening tools
  * Sleep Apnea Clinical Score (SACS)
  * Berlin Questionnaire
  * STOP–BANG Questionnaire
  * STOP–BANG plus serum bicarbonate

- Sensitivity and Specificity of Screening Tools
## STOP-Bang questionnaire

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Snoring?</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Do you <strong>snore loudly</strong> (loud enough to be heard through closed doors, or your bed partner elbows you for snoring at night)?</td>
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<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Tired?</th>
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<tbody>
<tr>
<td></td>
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<td>Do you often feel <strong>tired, fatigued, or sleepy</strong> during the daytime (such as falling asleep during driving)?</td>
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<tr>
<th>Yes</th>
<th>No</th>
<th>Observed?</th>
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<tr>
<td></td>
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<td>Has anyone <strong>observed</strong> you <strong>stop breathing or choking/gasping</strong> during your sleep?</td>
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<tr>
<th>Yes</th>
<th>No</th>
<th>Pressure?</th>
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<tr>
<td></td>
<td></td>
<td>Do you have or are being treated for <strong>high blood pressure</strong>?</td>
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<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Body mass index more than 35 kg/m²?</th>
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<tr>
<th>Yes</th>
<th>No</th>
<th>Age older than 50 years old?</th>
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<tr>
<th>Yes</th>
<th>No</th>
<th>Neck size large? (measured around Adam’s apple)</th>
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<tr>
<td></td>
<td></td>
<td>For male, is your shirt collar 17 inches or larger?</td>
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<tr>
<td></td>
<td></td>
<td>For female, is your shirt collar 16 inches or larger?</td>
</tr>
</tbody>
</table>

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<tr>
<th>Yes</th>
<th>No</th>
<th>Gender = Male?</th>
</tr>
</thead>
</table>

**Scoring criteria**:

- **For general population**
  - **Low risk of OSA**: Yes to 0 to 2 questions
  - **Intermediate risk of OSA**: Yes to 3 to 4 questions
  - **High risk of OSA**: Yes to 5 to 8 questions

OSA: obstructive sleep apnea

* For validated scoring criteria in obese patients, please refer to UpToDate topic on surgical risk and the preoperative evaluation and management of adults with obstructive sleep apnea.

**References**:

STOP-BANG & OSA Risk

• Increased risk of OSA: score $\geq 3$\textsuperscript{1}

• Increased risk of moderate-severe OSA: score $\geq 5$\textsuperscript{2}
  
  • Still very sensitive but not very specific ($\sim 30\%$)\textsuperscript{3}
  
  • STOP-BANG $\geq 3$ + serum $\text{HCO}_3$ $\geq 28$ increases specificity to $\sim 80\%$\textsuperscript{3}
Should all patients be screened preoperatively for OSA risk?

- **YES**
  * If high risk of OSA, complications higher.
  * Postoperative management is altered.
  * Avoidance of general anesthesia.

- **No**
  * Screening tools lack specificity.
  * Screening should be targeted
    (BMI > 40, bariatric surgery)
Preoperative sleep studies in high risk patients

- Low level of evidence

- Expert opinion:
  * Highest risk patients with non-urgent surg
    STOP–BANG > 5 or
    STOP–BANG > 2 and bicarb > 27 or
    “High Risk Surgery”
  * Do not delay urgent or emergent surg
The Patient with OSA: Preoperative Assessment

- Assess:
  - Severity of OSA
    - AHI 5–15 = Mild
    - AHI 16–30 = Moderate
    - AHI > 30 = Severe
  - Arrhythmias on sleep study or by history
  - Adequacy of OSA management
Postoperative Management of OSA: Post-op Bed Placement

- Insufficient literature to suggest:
  Step down unit vs. medical unit vs. ICU

- Consider higher intensity unit in patients with:
  * AHI > 30
  * Significant comorbidities
  * Recurrent PACU events
  * High opioid requirement
  * Pain-sedation mismatch
Oxygen Therapy

2014 ASA Guideline:

“Patients at high risk of respiratory compromise should have continuous pulse oximetry monitoring after discharge from the recovery room.”
Role for Capnography

- High risk patients in the PACU.
- Utility for patients on the floor?
  - * Pre-op bicaarbonante > 27
  - * STOP–BANG score > 4
Positioning

- NONSUPINE!
  - Lateral or semi-upright
  - Improves AHI
  - Reduces oxygen desaturation events
Pain Management

- Minimize opioid use
- Utilize non-opioid oral analgesics
- Utilize regional analgesic techniques
- Avoid benzodiazepines
- Non pharmacologic modalities
- PCA vs. Non-PCA parenteral analgesia
Positive Airway Pressure Therapy

- Patients on therapy pre-op
  * Resume at same settings
  * When to resume?
- Patients at high risk of OSA
  * Benefit of empiric therapy is unclear
    # AHI and oxygenation are better
    # Longer length of stay
- Expert opinion
  * Use PAP in the following situations:
    # Prolonged episodes of hypoxemia
    # Episodes of apnea or hypoventilation
Pulmonary Hypertension: Perioperative Management

- Paucity of data
- Substantial risk factor
- Types
Normal Pulmonary Circulation

- High flow, low pressure, low resistance
- < 10% of the resistance of systemic circulation
- Alveolar oxygen tension determines pulmonary arteriolar tone.
- Hypoxia mediated vasoconstriction shunts blood flow away from poorly ventilated areas of lung.
- Adaptability of right ventricle
Chronic Hypoxemia

- Sustained elevation in PA pressure
- Vascular remodeling
Pulmonary Hypertension: Surgical Risk

- Small volume of literature
- Most data is related to Pulmonary Arterial Hypertension
Pre-op evaluation of Pulm HTN: ACC 2014 Guideline

“Chronic pulmonary vascular targeted therapy should be continued…..” (Class I, LOE C)

“Unless the risks outweigh the potential benefits, preoperative evaluation by a pulmonary hypertension specialist can be beneficial for patients with pulmonary hypertension.” (Class IIa, LOE C)
Pre-op evaluation of Pulm HTN: Minai, et al (Chest 2013)

- Evaluate the cause and severity prior to surgery
- Consider the risk/benefit ratio of surgery
- Avoid any surgery other than minor surgery in patients with RV failure
Pulmonary Hypertension: Intra and Post-Operative Mgmt

- Maintain right ventricular perfusion
- Decrease right ventricular afterload
Normal individuals: Perfusion occurs during systole AND diastole.

As RV systolic pressures approach aortic systolic pressures, systolic blood flow to the RV becomes compromised.

When RV begins to fail, RV diastolic pressure rises, which reduces RV diastolic coronary blood flow.
Avascular increases in afterload poorly tolerated
40 mmHg increase in mean pressure will precipitate decreases in RV stroke volume in normal individuals

Conditions which will increase afterload:
* Hypoxia
* Acidosis
* Hypercarbia
* Pain
Pulmonary Hypertension Post-op Management

- In severe Pulmonary HTN, consider ICU placement
- Enhance perfusion:
  - Manage atrial arrhythmias aggressively
    - DC cardioversion
    - Amiodarone and flecainide are the drugs of choice
    - Avoid beta blockers???
  - Avoid systemic hypotension
  - CVP may reflect RV preload, but not LV preload
- Avoid factors that increase RV afterload
  (Hypoxia, hypercarbia, acidosis, poor pain control)
- Avoid oversedation (Hypercarbia elevates PVR)
Case #2

78 y/o female with no previous history of heart disease presents to the ED with her first episode of syncope. She had no prodromal symptoms prior to her syncopal episode and denies any chest pain, dyspnea, or palpitations.
Case #2

Past Medical History:
1) Hypertension: BPs have been 130’s systolic at home.
2) Primary hypothyroidism.

Medications:
* Levothyroxine 125 mcg po daily
* Lisinopril 20 mg po daily

ROS: Entirely unremarkable.
Case #2

Physical Exam:
* Comfortable, looks younger than state age
* 132/65, 102, 16, 98.2, 92% on room air.
* Bp 135/64 supine and 139/72 standing.
* S1 and S2, regular; no murmur.
* Lungs clear to auscultation and moving air well.
* No lower extremity edema.
Case #2

Laboratory evaluation:

WBC 10.0; Hgb 13.0; PLT 275 K
Na 138; K 4.0; Creat 1.0; BUN 12

12 lead ECG:

Sinus tachycardia 102 bpm. Otherwise normal.
Case #2

The next step in this patient’s evaluation should be:

A) Carotid ultrasound.
B) Transthoracic Echocardiogram.
C) D-dimer.
D) Consult cardiology.
Objective: To determine the prevalence of pulmonary embolism in patients admitted to the hospital for syncope.

Design: Prospective cross-sectional observational study

Primary Outcome: Pulmonary embolism diagnosed via CT scan, V/Q Scan, or autopsy in patients admitted with their first episode of syncope.
Inclusion Criteria

• 18 years or older
• First episode of syncope
• Admitted to 1 of 11 participating hospitals
Pulmonary Embolism and Syncope

Exclusion Criteria:

• Previous episodes of syncope
• Receiving anticoagulant therapy
• Pregnant
Pulmonary Embolism and Syncope

**Study Methodology:**

- 2584 Pts presented to ED with Syncope
- 1867 discharged from ED
  - 829 with vasovagal
  - 465 with situational
  - 380 with drug-induced
  - 112 with volume depletion
  - 81 declined hospitalization
- 717 Pts admitted to the hospital
STUDY METHODOLOGY

717 Pts admitted to the hospital

157 pts excluded
- 118 receiving anticoagulation tx
- 82 had a-fib
- 36 had other reasons
- 35 had recurrent syncope
- 4 decline to participate

560 study pts
Study Methodology:

- 560 study pts
- 330 with low pre-test probability and negative D-dimer
- 230 with high pre-test probability, positive D-dimer, or both
  - CT, V/Q Scan, Autopsy
    - 97 with confirmed PE
  - 463 with PE ruled out
Pulmonary emboli and syncope

Results:

63% of the pulmonary emboli were in a main pulmonary artery or lobar artery.
Results

PE diagnosed in 97 out of 560 hospitalized patients.

Prevalence = 17.3% (95% CI, 14.2% to 20.5%)
Results:

The overall prevalence among all patients, including those sent home from the ED, who presented with syncope was 3.8%
Pulmonary Embolism and Syncope

Syncope

Pre-test probability

100%

0%

Vasovagal
Situational
Drug-induced hypotension
Volume depletion
Case #3

The Hospitalist Service is asked to consult on an 80 year old female who presented to the hospital 4 days ago with a right femoral neck fracture after a traumatic fall. Three days ago, she had a right hemiarthroplasty. Her postoperative course was unremarkable until she had a syncopal episode earlier today.
The patient had no prodromal symptoms with her syncopal episode, denies any previous episodes of syncope, and was not on telemetry during the episode. She lost consciousness for 30 seconds and was alert and without confusion immediately after the episode.

The patient denies any chest pain, palpitations, or dyspnea.
Case #3

Past Medical History:

* Hypertension
* Osteoporosis with previous lumbar compression fracture
* Diabetes mellitus, II; controlled with oral agents.
Case #3

Medications:

Lisinopril 10 mg po daily
Ondansetron 4 mg po q 8 hrs prn
Oxycodone 5–10 mg po q 4 hrs prn
Acetaminophen 500–1000 mg po q 6 hrs prn
Levemir 12 Units SC qHS
Humalog correction scale
Enoxaparin 40 mg SC q 24 hrs
Case #3

PHYSICAL EXAM

126/72 (without orthostatic change)  
84  14  Afebrile  94% (1 L/min)

CV: No murmur. Trace bilateral pretibial edema.
Pulm: No rales, rhonchi, or wheezes.
Laboratory studies:
- Troponin normal x 2 over six hours
- Hemoglobin 9.5 (9.6 two days ago)
- WBC 9.5 K
- Creatinine 1.1 (unchanged from baseline)

12 lead ECG:
- NSR, NSTW abnormality, unchanged from pre-op ECG.
The Hospitalist consulting on this case recalls recently reading Prandoni’s article and therefore gives consideration of pulmonary emboli as the cause of this patient’s syncope. Knowing that the patient’s D–dimer is almost surely to be elevated, she orders a CTA chest.

CTA chest reveals a subsegmental pulmonary embolus.
Case #3

The next logical step in the management of this patient should be:

A) Draw a hypercoagulable panel.
B) Increase enoxaparin to 1 mg/kg SQ q 12 hrs.
C) Order a bilateral lower extremity venous doppler.
D) B and C are correct.
Subsegmental PE

- Subsegmental PE: confined to the subsegmental pulmonary artery
  - A true subsegmental PE is thought to be likely to have arisen from a small DVT.

- Unclear how clinically relevant these events are, and thus unclear whether or not to treat these events with anticoagulants as risk may be > benefit

- Diagnosis is more likely to be a false positive finding compared to a diagnosis of PE in the segmental or more proximal pulmonary arteries
Subsegmental PE

• With new advancements in imaging, diagnosis of these events has increased.

• In patients diagnosed with a subsegmental PE and confirmed to have no proximal DVT and have a low risk for a recurrent clotting event, surveillance is recommended over anticoagulation (Grade 2C)

• But if patient has a high risk for recurrent VTE, anticoagulation is recommended over surveillance (Grade 2C).
Patients with OSA or high risk of OSA:

* Incorporate screening into your practice.

* Utilize continuous pulse oximetry postop.

* Proper positioning post op!

* Utilize non-opioid alternatives postop.

* Have a low threshold for utilizing CPAP/BIPAP postop.
**SUMMARY**

Moderate to Severe Pulmonary Hypertension:
* Preserve right ventricular perfusion

Consider pulmonary embolus in select patients with syncope.

Not all patients with subsegmental PE require anticoagulation.
QUESTIONS ?