PERIOPERATIVE MANAGEMENT OF OSA PATIENT & NEW FRONTIERS IN ALTERNATIVE THERAPIES

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SCREENING QUESTIONNAIRES

TABLE 2
STOP-BANG questionnaire*

<table>
<thead>
<tr>
<th>STOP</th>
<th>Bang</th>
<th>STOP-BANG questionnaire*</th>
</tr>
</thead>
<tbody>
<tr>
<td>S (snore)</td>
<td>4</td>
<td>Do you snore loudly? (You can be in bed, talking or loud enough to be heard through closed doors?)</td>
</tr>
<tr>
<td>T (tired)</td>
<td>4</td>
<td>Do you feel tired all the time, even after 7 to 9 hours of sleep?</td>
</tr>
<tr>
<td>O (obstructive sleep apnea)</td>
<td>4</td>
<td>Do you have significant obstructive sleep apnea?</td>
</tr>
<tr>
<td>N (neck)</td>
<td>4</td>
<td>Neck circumference 40 cm</td>
</tr>
<tr>
<td>A (age)</td>
<td>4</td>
<td>Age 50 years or older</td>
</tr>
<tr>
<td>G (gender)</td>
<td>2</td>
<td>Male</td>
</tr>
</tbody>
</table>

STOP-BANG = STOP-Bang

TOTAL SCORE

OSA (ALMOST 1 BILLION WORLDWIDE)

PROBABILITY OF OSA SEVERITY BASED ON SNORING
PERIOPERATIVE MANAGEMENT GUIDELINES FOR OSA PATIENTS FROM AMERICAN SOCIETY OF ANESTHESIOLOGISTS TASK FORCE 2014

PREOPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

• Precautions should be taken in anticipating the possibility of having a difficult airway.
• Most patients may be obese and appropriate care should be taken to prevent desaturation.
• It is useful to employ short-acting anesthetic drugs, less soluble inhalational agents, titrate opioids, and minimize sedation.
• In patients with anticipated difficult airways, awake extubation may have to be performed preferably in a 30° to 45° head-up position.
• The routine perioperative care may be adequate for patients with mild OSA. If patients have any co-morbidities, they should be optimized.
• Patients may benefit by the modifications of anesthetic technique such as avoidance of general anesthesia in favor of a central neuraxial or a peripheral nerve block.

POST-OPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

• Postoperative concerns in the management of patients with OSA include:
  (1) analgesia, (2) oxygenation, (3) patient positioning, (4) monitoring.
• Risk factors for respiratory depression include the systemic and neuraxial administration of opioids, administration of sedatives, site and invasiveness of surgical procedure, and severity of the sleep apnea.
• Postoperative residual curarization is common after administration of neuromuscular blocking agents.
• Suggested practices include verification of full neuromuscular blockade recovery, ensuring the patient is fully conscious prior to extubation, and placing the patient in a semi-upright recovery position. Anticipating possible difficult airways, use of short-acting anesthetic agents, opioid minimization, reversal prior to extubation, and extubation in a non-supine position.

PREOPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

<table>
<thead>
<tr>
<th>Preoperative period</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSA risk stratification, evaluation and optimization.</td>
</tr>
<tr>
<td>Optimization of associated comorbidities.</td>
</tr>
<tr>
<td>Anesthetic management tailored to individual needs.</td>
</tr>
<tr>
<td>Preoperative CPAP or BiPAP continued perioperatively or start if patient previously noncompliant.</td>
</tr>
</tbody>
</table>

POST-OPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

<table>
<thead>
<tr>
<th>Post-operative concerns</th>
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<tbody>
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<td>(1) analgesia, (2) oxygenation, (3) patient positioning, (4) monitoring.</td>
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POST-OPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

• Opioids suppress REM and slow wave sleep.
• REM rebound contribute to haemodynamic instability, myocardial ischemia and infarction, stroke, mental confusion and wound breakdown.
• Exacerbation of respiratory depression may occur on the third or fourth postoperative day as sleep patterns are reestablished and “REM rebound” occurs.

Post-operative optimization of patients with known or suspected OSA

• Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air.
• The Task Force cautions that supplemental oxygen may increase the duration of apneic episodes and may hinder detection of atelectasis, transient apnea, and hypoventilation by pulse oximetry.
• CPAP or BiPAP, with or without supplemental oxygen, should be continuously administered when feasible to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure.

POST-OPERATIVE OPTIMIZATION OF PATIENTS WITH KNOWN OR SUSPECTED OSA

• Compliance with CPAP or BiPAP may be improved if patients bring their own equipment to the hospital.
• Intermittent pulse oximetry or continuous bedside oximetry without continuous observation does not provide the same level of safety.
• If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or BiPAP should be considered.

MANAGEMENT OF PATIENTS SCHEDULED FOR AMBULATORY SURGERY

• Due consideration must be given to
1- The type of surgery, 2- Associated co-morbidities, 3- Patient’s age, 4- Severity of OSA
5- The treatment status
6- Anticipated use of postoperative opioids
7- The type of anesthesia (local vs general vs nerve blocks with or without sedation) and
8- Home care.
• The American Society of Anesthesiologists Advisory Guidelines on the Perioperative management of patients with OSA suggests that superficial surgeries or minor orthopedic surgery using local or regional techniques, and lithotripsy, may be done on an ambulatory basis.
CONSULTANT OPINIONS REGARDING PROCEDURES THAT MAY BE PERFORMED SAFELY ON AN OUTPATIENT BASIS FOR PATIENTS AT INCREASED PERIOPERATIVE RISK FROM OSA

<table>
<thead>
<tr>
<th>Type of Surgery/Anesthesia</th>
<th>Consultant Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial surgery/local or regional anesthesia</td>
<td>Agree</td>
</tr>
<tr>
<td>Superficial surgery/general anesthesia</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Airway surgery (adult, e.g., UPPP)</td>
<td>Disagree</td>
</tr>
<tr>
<td>Tonsillectomy in children less than 3 years old</td>
<td>Disagree</td>
</tr>
<tr>
<td>Tonsillectomy in children greater than 3 years old</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Minor orthopedic surgery/local or regional anesthesia</td>
<td>Agree</td>
</tr>
<tr>
<td>Minor orthopedic surgery/general anesthesia</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Gynecologic laparoscopy</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Laparoscopic surgery, upper abdomen</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Lithotripsy</td>
<td>Agree</td>
</tr>
</tbody>
</table>

OSA = obstructive sleep apnea; UPPP = uvulopalatopharyngoplasty.

Management of patients scheduled for ambulatory surgery

- Patients with regional anesthesia also have elevated AHI and oxygen desaturation. This may imply that OSA patients need to be treated with CPAP.
- Regarding ambulatory surgery, short-acting anesthetic agents and non-invasive surgery typically makes this a safer option for patients with OSA.
- Severe untreated or undiagnosed OSA requiring postoperative narcotics after ambulatory surgery may be unsafe.
- The consultants indicated that monitoring of patients with OSA should continue for a median of 7 h after the last episode of hypoxemia while breathing room air in an unstimulating environment.

MANAGEMENT OF PATIENTS SCHEDULED FOR AMBULATORY SURGERY

- Patients may be discharged to home provided that there is no moderate or severe OSA, no recurrent adverse events in postanesthesia care unit (PACU) such as apnea or desaturation, and no requirement of postoperative opioid.
- It is important to realize that ambulatory surgical facilities managing OSA patients should have transfer arrangements to an inpatient facility, and be equipped to handle the potential problems that may arise while dealing with OSA patients.
THE OCCURRENCE OF RECURRENT RESPIRATORY EVENTS IN PACU CAN BE USED AS A RELIABLE INDICATOR TO DETERMINE WHETHER THE KNOWN OR SUSPECTED OSA PATIENT REQUIRES CONTINUOUS POSTOPERATIVE MONITORING.

• The PACU respiratory event is defined as either:-
  1- An apnea for ≥ 10 s (1 episode needed for yes),
  2- Bradypnea of < 8 breaths per minute (3 episodes needed for yes),
  3- Pain-sedation mismatch, or
  4- Desaturations to < 90% (3 episodes needed for yes) in one 30-minute time block.

The event is considered significant when any of one of them occurs in two separate 30-minute time blocks. This will make it possible to identify the majority of OSA patients that require further monitoring.

• It is highly likely that these patients may require CPAP therapy.

• Patients with OSA have a more profound increase in AHI on postoperative night 3 and return to preoperative levels on night 7.

SPECIAL CONSIDERATIONS FOR POSTOPERATIVE MANAGEMENT

Postoperative analgesia

• OSA is one of the major risk factors contributing to the occurrence of respiratory depression.

• The use of opioids can be a special concern in patients with OSA, as most opiates including morphine, meperidine, hydromorphone, and fentanyl cause a dose-dependent reduction of respiratory drive, respiratory rate, and tidal volume that in turn can lead to hypoventilation, hypoxemia, and hypercarbia.

• Sedatives, anesthetics and analgesics may selectively compromise respiratory function in OSA patients.

• The general recommendation is that opioids and other drugs with central respiratory and sedating effects should be avoided, if possible. It is imperative to minimize the use of opioids in diagnosed or suspected OSA patients.

POSTOPERATIVE ANALGESIA

• The use of morphine in OSA has been deleterious with reports of respiratory depression and even death.

• There may be genetic factors that may play a role in having differing effects on opioid induced respiratory effects.

• Oxygen desaturations were 12 to 14 times more likely to occur in OSA patients receiving oral or parenteral opioids as opposed to those receiving non-opioid analgesic agents.
**ALTERNATIVE TO OPIOID THERAPY**

- The use of multimodal analgesia may be more beneficial in patients with OSA in minimizing the opioid-related side effects and providing effective analgesia as well.
- There are a plethora of medications that can be used, such as nonsteroidal anti-inflammatory drugs, acetaminophen, tramadol, ketamine, gabapentin, and pregabalin.
- Caution should be advocated while using some of these drugs like gabapentin with the side effect of sedation. Dexmedetomidine has been particularly beneficial because of the opioid sparing effect and the lack of respiratory depression.

**ALTERNATIVE TO OPIOID THERAPY**

- The American Society of Anesthesiologists guidelines recommend regional anesthesia to reduce the possibility of negative adverse events associated with systemic opioids.
- The use of nonsteroidal anti-inflammatory analgesics is strongly recommended.
- The use of nerve blocks with or without catheters with local anesthetics obviates the need for systemic opioid analgesics.
- Caution should be exercised in using neuraxial opioids in patients with OSA as there are reports of postoperative respiratory arrest in a case series of three patients.
- Patients with OSA may be at an increased risk of perioperative complications with the use of strong opioids even after a regional anesthetic.

**EVIDENCE FOR USING PERIOPERATIVE CPAP**

- CPAP exerts its beneficial effects by acting as a pneumatic splint and prevents the obstruction to airflow during sleep.
- Postoperative CPAP reduces airway obstruction, reduces major postoperative complications and shortens the hospital stay.
- The American Society of Anesthesiologists task force recommends that patients continue with their routine CPAP through the perioperative period.
- The patients are better advised to get their own CPAP device to the hospital on the day of surgery.

**GOTHIC ARCH/MAXILLARY HYPOPLASIA**
VALLECTULAR CYST

EARLY ATTEMPTS TO DESCRIBE OBSTRUCTION

TONSIL SIZE 1 – 4+ BRODSKY SCALE

FRIEDMAN TONGUE POSITIONS I-IV
UPPER PHARYNX PHENOTYPES

PALATAL SHAPE (WOODSON)

WHAT'S ON THE MENU FOR OROPHARYNGEAL SURGERY

- UPPP
- Modified UPPP
- Z plasty
- Palatal advancement
- Expansion sphincteroplasty
- Lateral sphincteroplasty
- THE GOAL IS TO MOVE RATHER THAN REMOVE

FUJITA UPPP 1980
FUGITA UPPP

EXPANDED MENUE
EXPANSION PHARYNGOPLASTIES/SPHINCTEROPLASTIES

TRANSPALATAL ADVANCEMENT PHARYNGOPLASTY

HYOID SUSPENSION
LINGUAL TONSILLECTOMY/MIDLINE GLOSSECTOMY/TORS DA VINCI

EXPANSION OF SKELETAL BOX/ MMA 85% SUCCESS BUT 15%+ COMPLICATIONS

INTERNAL COMBUSTION ENGINE
CARL BENZ 1886
**DISE** is a peer-reviewed method for selecting patients prior to OSA surgical therapies.

### VOTE Method

1. **Level, Degree, Direction**

<table>
<thead>
<tr>
<th>Airway Level</th>
<th>Anterior-Posterior</th>
<th>Lateral</th>
<th>Concentric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velopharynx</td>
<td>Dipharynx</td>
<td>Tongue Base</td>
<td>Epiglottis</td>
</tr>
</tbody>
</table>

**Degree:**
- None (0%) – no to little obstruction, 0-25%
- Partial (25-75%)
- Complete (>75%)

- Flexible nasal endoscopy under moderate sedation in the supine position
- Sedation stage: 10-15 mins; Evaluation stage: 10 mins; Recovery quick
- Performed for decades and safe, >7500 procedures without side effects or emergency

### All AP velopharynx collapse types Neuro stim

<table>
<thead>
<tr>
<th>None (0-25%)</th>
<th>Partial AP (25-75%)</th>
<th>Complete AP (&gt;75%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare</td>
<td>Common</td>
<td>Common</td>
</tr>
</tbody>
</table>

- Soft palate remains open during inspiration
- Partial closure of soft palate throughout respiratory cycle
- Evolves to complete collapse over 2 cycles

### VELOPHARYNX: ANTERIOR-POSTERIOR COLLAPSE PATIENTS ARE ELIGIBLE (VIDEOS)

- Complete concentric collapse at the velopharynx is a Neuro stim contra-indication

<table>
<thead>
<tr>
<th>Complete concentric (75-100%)</th>
<th>Complete Concentric (100%)</th>
<th>Complete concentric appearing as AP+LL</th>
</tr>
</thead>
</table>

- Complete concentric collapse may contain a small open lumen
- Collapse evolves to complete concentric during the apnea
- Concentric collapse may also appear as simultaneous AP and lateral collapse

### Complete concentric collapse at the velopharynx is a Neuro stim contra-indication

- Complete concentric collapse appearing as AP+LL

### EPIGLOTTIS: REVIEW FOR COLLAPSE TYPES

<table>
<thead>
<tr>
<th>None (0-25%)</th>
<th>Partial AP (25-75%)</th>
<th>Complete AP (&gt;75%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Epiglottis does not block the airway
- Epiglottis partially blocking the airway
- Airway occluded by the epiglottis

- Ensure the epiglottis is within 75% of the scope area
- Epiglottis collapse is not an exclusion criteria
**Post-Implant X-rays \( \times 2 \)**
Document Implant Positions & Integrity

- Lateral view, showing stim cuff electrode
- AP view, showing IKG/foam wrap and sensing lead

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**HYPOGLOSSAL NERVE STIMULATION EFFECT**

- No Stimulation
- Mild Stimulation

**UPPER AIRWAY STIMULATION EFFECT**

- EEG
- EMG
- Nasal
- Therm
- Chest
- Abdm
- SaO₂

**REDUCED OSA SEVERITY**

- Therapy significantly reduced OSA severity

\[ p < 0.0001 \]

- 68% reduction
- 70% reduction

**THERAPY EFFECT ON REPORTED SNORING**

- **Partner Report**

  - Therapy Effect on Snoring
    - 18% partners reported no or soft snoring at baseline
    - 85% partners report no or soft snoring by participants with therapy
    - Bed partner leaves room reduced from 30% to 5%

  ![Diagram](image)

**CURRENT OTHER HGN STIM PRODUCTS IMTHERA AND NYXOAH**

![Images](image)

![Cartoon](image)
PHENOTYPE VS. ENDOTYPE

• “Observable properties of an organism that are produced by the interactions of the genotype and the environment.”

• "A specific biological pathway is identified that explains the observable properties of a phenotype.”

BEYOND AHI, INTEGRATING PALMS SCALE IN TREATMENT DECISION ANALYSIS

• $P_{CRIT}$
• AROUSAL THRESHOLD
• LOOP GAIN
• MUSCLE REACTIVITY

STARLING RESISTOR TO PALM CONCEPT (NEW DIMENSIONS OF UNDERSTANDING OSA)

PALM MANIPULATION (FRONTIERS IN INDIVIDUALIZED THERAPY)

• $P_{CRIT}$ – desipramine (increase genioglossus activity)
• Arousal threshold – trazodone, eszopiclone (increase)
• Loop gain – O₂, acetazolamide (decrease)
• Muscle reactivity – paroxetine, mirtazapine (upper airway dilator activation)