Perioperative Management of Patients with Obstructive Sleep Apnoea – Anaesthesia Challenges

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Introduction

- OSA: characterised by periodic, partial or complete obstruction of the upper airway during sleep
- Prevalence:
  higher in surgical population
- 80-90% of patients with OSA are undiagnosed
- It is known to be an independent risk factor for increased postoperative morbidity and mortality
Definition of OSA

- OSA: cessation of airflow for more than 10s, 5 or more times per hour of sleep

- Obstructive sleep hypopnoea (OSH): decrease in airflow of more than 50% for more than 10s, 15 or more times per hour of sleep
Prevalence of Undiagnosed Obstructive Sleep Apnoea Among Adult Surgical Patients in an Academic Medical Center

- Methods: Prospective, observational study-surgical patients screened for OSA

- Screening questionnaire: The apnoea risk evaluation system

- 2877 pts screened

- 661 high risk for OSA (534 without a prior diagnosis of OSA)

Prevalence of Undiagnosed Obstructive Sleep Apnoea Among Adult Surgical Patients in an Academic Medical Center

- 207 had valid home sleep studies. 170 of these patients had OSA.
- 82% undiagnosed in the high risk population

Fig. 1. Flow diagram of the study.

Perioperative Pulmonary Outcomes in Patients with Sleep Apnoea After Noncardiac Surgery

- Methods: National inpatient sample data btw 1998 and 2007. Orthopaedic and general surgical procedures were included.

- Primary outcomes: Aspiration pneumonia, ARDS, PE and the need for intubation and mechanical ventilation.

- Results: 2,610,441 entries for orthopaedic cases
  - 2.54% had OSA
3,441,262 entries for general surgical procedures
  - 1.4% had OSA

- Conclusion: OSA is an independent risk factor for perioperative pulmonary complications.
Perioperative Pulmonary Outcomes in Patients with Sleep Apnea After Noncardiac Surgery.
Memtsoudis, Stavros; MD, PhD; Liu, Spencer; Ma, Yan; Chiu, Ya; Walz, J; Gaber-Baylis, Licia; Mazumdar, Madhu
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Figure 1. Incidence of respiratory complications for patients with and without sleep apnea (SA) undergoing orthopedic (A) and general surgical (B) procedures for patients utilizing the full and matched sample. ARDS = adult respiratory distress syndrome; PE = pulmonary embolism; AE = adverse event.
<table>
<thead>
<tr>
<th>Procedure type and outcome</th>
<th>OR (95% CI)</th>
<th>CER (%)</th>
<th>EER (%)</th>
<th>ARR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General surgical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>1.37 (1.33, 1.41)</td>
<td>2.05</td>
<td>2.79</td>
<td>0.74 (0.66, 0.81)</td>
</tr>
<tr>
<td>ARDS</td>
<td>1.58 (1.54, 1.62)</td>
<td>2.44</td>
<td>3.79</td>
<td>1.35 (1.26, 1.44)</td>
</tr>
<tr>
<td>PE</td>
<td>0.90 (0.84, 0.97)</td>
<td>0.49</td>
<td>0.45</td>
<td>0.05 (0.01, 0.08)</td>
</tr>
<tr>
<td>Intubation/mechanical ventilation</td>
<td>1.95 (1.91, 1.98)</td>
<td>5.94</td>
<td>10.8</td>
<td>4.87 (4.73, 5.01)</td>
</tr>
<tr>
<td>Orthopedic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>1.41 (1.35, 1.47)</td>
<td>0.84</td>
<td>1.18</td>
<td>0.34 (0.30, 0.39)</td>
</tr>
<tr>
<td>ARDS</td>
<td>2.39 (2.28, 2.51)</td>
<td>0.45</td>
<td>1.06</td>
<td>0.61 (0.57, 0.65)</td>
</tr>
<tr>
<td>PE</td>
<td>1.22 (1.15, 1.29)</td>
<td>0.42</td>
<td>0.51</td>
<td>0.09 (0.06, 0.12)</td>
</tr>
<tr>
<td>Intubation/mechanical ventilation</td>
<td>3.20 (3.05, 3.37)</td>
<td>0.79</td>
<td>3.99</td>
<td>3.19 (3.12, 3.27)</td>
</tr>
</tbody>
</table>

OR = odds ratio; CER = control event rate; EER = experimental event rate; ARR = absolute risk reduction; ARDS = acute respiratory distress syndrome; PE = pulmonary embolism; CI = confidence interval.
How does perioperative state impact sleep?

- Anaesthesia and surgery affect the architecture of sleep. Both suppress REM 1\textsuperscript{st} night post-op.

- REM returns on 3\textsuperscript{rd} or 4\textsuperscript{th} post-op night with increased duration and density → REM sleep associated hypoxaemic episodes increase about 3-fold.

- Loss of muscle tone results in pharyngeal collapse during deep NREM and REM sleep.

- Sedatives and opioids depress the ventilatory and arousal responses to hypoxia and hypercarbia.
Pathophysiology of Obstructive Sleep Apnoea

Obesity and OSA

- Decreased pharyngeal area in obesity – deposition of adipose tissue into pharyngeal tissues
- Extraluminal pressure is increased by superficially located fat masses (neck) → the upper airway is compressed externally
How Can OSAS Affect Perioperative Outcomes

- Systemic pathophysiology of OSA
- REM rebound may contribute to haemodynamic instability, MI, CVA, mental confusion and wound breakdown
- Hypoxia $\rightarrow$ arrythmias $\rightarrow$ angina and MI
- Increased sympathetic tone $\rightarrow$ diurnal pulmonary and systemic hypertension

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Assess for possible sleep apnoea

- History
  - Risk factors: obesity, old age, male sex, female menopause, alcohol intake
  - Daytime somnolence, witnessed snoring or apnoeic episodes, morning headaches
  - Consider using STOP-Bang screening tool
  - CPAP – compliance, CPAP setting
- Symptoms of right heart failure
- Exam: Collar/neck size, BMI, HTN, signs of right heart failure
- Consider ECHO
Diagnosis

- Polysomography
  EEG, EOG, EMG, oral and nas sensors, capnography ECG, S(BP
  - Apnoea-Hyponoea Index
    - Mild: 5-15
    - Moderate: 16-30
    - Severe: >30
STOP-Bang Questionnaire

1. Snoring: Do you snore loudly (loud enough to be heard through closed doors)?
   - Yes
   - No

2. Tired: Do you often feel tired, fatigued, or sleepy during daytime?
   - Yes
   - No

3. Observed: Has anyone observed you stop breathing during your sleep?
   - Yes
   - No

4. Blood pressure: Do you have or are you being treated for high blood pressure?
   - Yes
   - No

5. BMI: BMI more than 35 kg m⁻²?
   - Yes
   - No

6. Age: Age over 50 yr old?
   - Yes
   - No

7. Neck circumference: Neck circumference >40 cm?
   - Yes
   - No

8. Gender: Male?
   - Yes
   - No

- High risk: Yes to more than 3 qs
- Mod: Yes to < 3 qs

Chung F, Subramanyam et al
Case Scenario

70 yo male admitted for elective TKR
Recently diagnosed moderate OSA
BG: Smoker, HTN, BMI 40
Non-compliant to CPAP due to discomfort
No preoperative assessment (pt is assessed in anaesthetic bay)
What would you do?
Practice Guidelines for the Perioperative Management of Patients with OSA

Intraoperative Management

- Choice of anaesthetic technique
- Regional vs GA
- Patient monitoring
- Airway management
- Full reversal of neuromuscular block before extubation
**CHOICE OF OPIOIDS**

<table>
<thead>
<tr>
<th>Drug</th>
<th>$t_{1/2}k_{e0}$</th>
<th>Elimination $t_{1/2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remifentanil</td>
<td>1 minute</td>
<td>0.5 hour</td>
</tr>
<tr>
<td>Alfentanil</td>
<td>1 minute</td>
<td>1 hour</td>
</tr>
<tr>
<td>Sufentanil</td>
<td>6 minutes</td>
<td>8 hours</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>5 minutes</td>
<td>8–10 hours</td>
</tr>
<tr>
<td>Morphine</td>
<td>2–4 hours</td>
<td>2–3 hours</td>
</tr>
<tr>
<td>Methadone</td>
<td>8 minutes</td>
<td>24–36 hours</td>
</tr>
</tbody>
</table>

*Table 1. Onset of Effect and Elimination of Opioids*
Postoperative Management

- Extubate to CPAP at home settings
- Supplemental oxygen
- HDU care or continuous pulse oximetry monitoring by telemetry
- Positioning: Semi-upright (30-45 degrees) or lateral positioning
Postoperative Management

- Who should be monitored in HDU?
  - Pts with severe OSA
  - Pts with OSA undergoing abdominal or invasive surgery
  - Pts who have significant expected pain and require opioid therapy
  - CPAP machine at home
Exacerbation of respiratory depression may occur on the 3\textsuperscript{rd} or 4\textsuperscript{th} postoperative day as sleep patterns are reestablished and REM rebound occurs → most at risk of respiratory compromise.
Survey: The use of protocols to manage patients with OSA

- A questionnaire survey was sent to 199 Consultant anaesthetists based in 102 hospitals in the UK. They were asked if their anaesthetic department had a protocol for the management of sleep apnoea patients after operation and related questions about the use and availability of CPAP.

- Seventy-two replies were received. Only 4% of respondents stated that their hospital had a protocol for the postoperative management of sleep apnoea patients.

Summary

- Sleep apnoea is often undiagnosed in high-risk population
- The risk of OSA rises with increasing body weight and age.
- Undetected and untreated OSA is associated with significant perioperative complications and postoperative morbidity
- Preoperative screening of OSA, titration and choice of anaesthesia/analgesia and careful postoperative monitoring could avoid many complications after surgery
References


- Danny J. Eckert1 , Atul Malhotra. Pathophysiology of OSA. Proc Am Thorac Soc February 15, 2008 vol. 5 no. 2 144-153


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