Peri-operative Management of Obstructive Sleep Apnoea

Matthew T. Naughton MD FRACP
Alfred Hospital, Melbourne, Australia
Fritz Kahn
1888-1968

Der Mensch als Industriepalast
Fritz Kahn
1888-1968
Case: 46yo male, BMI=35, smoker, single, loud snorer, 2 drug hypertension, myocardial infarct 12 mths ago, Presents for semi-urgent CAGS?
Outline

- Evidence of OSA -> perioperative complications
- OSA pathophysiology & Rx
- Weaning from Intubation
OSA Contributes to Post-Operative Complications

<table>
<thead>
<tr>
<th>Surgery type</th>
<th>RxOSA</th>
<th>↑ LOS &amp; Complications</th>
</tr>
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<tbody>
<tr>
<td>General OP(^5)</td>
<td>yes</td>
<td>N</td>
</tr>
<tr>
<td>Ortho(^3)</td>
<td>no</td>
<td>33%</td>
</tr>
<tr>
<td>General IP(^4,7,8)</td>
<td>no</td>
<td>N/Y</td>
</tr>
<tr>
<td>Bariatric(^6)</td>
<td>85%</td>
<td>-</td>
</tr>
<tr>
<td>CAGS(^1,2)</td>
<td>no</td>
<td>8%</td>
</tr>
</tbody>
</table>

1. Mooe Cor Art Dis 1996;7:475-78;
8. Memtsoudis et al. Anesth & Analg 2011;112:113
**OSA Contributes to Post-Operative Complications**

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1. Mooe Cor Art Dis 1996;7:475-78;
8. Memtsoudis et al. Anesth & Analg 2011;112:113
172 consecutive pts awaiting surgery with ≥ 2 features of OSA underwent oximetry study

Features of OSA
- Regular snoring
- Excessive sleepiness
- Witnessed apnoeas
- Crowded oro-pharynx

<table>
<thead>
<tr>
<th>Variables</th>
<th>ODI4% &lt; 5</th>
<th>ODI4% ≥ 5</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODI</td>
<td>1.9 ± 1.4</td>
<td>21.9 ± 17.4</td>
<td></td>
</tr>
<tr>
<td>Age, yr</td>
<td>52.7 ± 14.3</td>
<td>55.9 ± 12.9</td>
<td>NS</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>97.4 ± 26.3</td>
<td>106.6 ± 27.1</td>
<td>0.02</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>34.0 ± 9.0</td>
<td>36.5 ± 8.7</td>
<td>0.054</td>
</tr>
<tr>
<td>Complication rate</td>
<td>2.7</td>
<td>15.3</td>
<td>0.008</td>
</tr>
</tbody>
</table>
## Major Non-Cardiac Surgery–unRx OSA

Kaw et al. Chest 2012;141:436-441

<table>
<thead>
<tr>
<th></th>
<th>No Apnea (n=282)</th>
<th>Apnea (n=189)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial Fibrillation</td>
<td>0</td>
<td>1.1 **</td>
</tr>
<tr>
<td>Myocardial Ischemia</td>
<td>0</td>
<td>0.7 **</td>
</tr>
<tr>
<td>Delerium</td>
<td>0</td>
<td>3.4 **</td>
</tr>
<tr>
<td>CHF</td>
<td>0</td>
<td>1.1 **</td>
</tr>
<tr>
<td>Post hyopoxemia</td>
<td>2.1</td>
<td>12.4 **</td>
</tr>
<tr>
<td>Respiratory Failure</td>
<td>2.1</td>
<td>4.9 **</td>
</tr>
<tr>
<td>ICU</td>
<td>1.6</td>
<td>6.7 **</td>
</tr>
<tr>
<td>Any Complication</td>
<td>2.6</td>
<td>14.2 **</td>
</tr>
<tr>
<td>LOS &gt; 2days</td>
<td>28</td>
<td>48.2 **</td>
</tr>
<tr>
<td>LOS mean (range)</td>
<td>1 (0-3)</td>
<td>2 (0-4) *</td>
</tr>
</tbody>
</table>
Bariatric Surgery & OSA

NEJM 2009; 361:116-26

- 1\(^0\) outcome: 30D Death / DVT / re-intervention / failure to discharge
- 4776 / 5648 pts

**Results-1**

<table>
<thead>
<tr>
<th></th>
<th>LAGB</th>
<th>LRYGB</th>
<th>ORYGB</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>25</td>
<td>62</td>
<td>9</td>
</tr>
<tr>
<td>Death (%)</td>
<td>0</td>
<td>0.2</td>
<td>2.1</td>
</tr>
<tr>
<td>1(^0) outcome (%)</td>
<td>1</td>
<td>4.8</td>
<td>7.8</td>
</tr>
<tr>
<td>OSA Dx (%)</td>
<td>45</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>UnRxOSA (%)</td>
<td>7</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

**Results-2**

RISKS: Type of procedure, ↑↑ BMI, WD<60M, past DVT, OSA
# OSA Contributes to Post-Operative Complications

<table>
<thead>
<tr>
<th>Surgery type</th>
<th>RxOSA</th>
<th>↑ LOS &amp; Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>General OP^5</td>
<td>yes</td>
<td>N</td>
</tr>
<tr>
<td>Ortho^3</td>
<td>no</td>
<td>33% x 6</td>
</tr>
<tr>
<td>General IP^4,7,8</td>
<td>no</td>
<td>N/Y x 2</td>
</tr>
<tr>
<td>Bariatric^6</td>
<td>85%</td>
<td>- Y</td>
</tr>
<tr>
<td>CAGS^1,2</td>
<td>no</td>
<td>8% x 2 (&amp; AF)</td>
</tr>
</tbody>
</table>

1. Mooe Cor Art Dis 1996;7:475-78
8. Memtsoudis et al. Anesth & Analg 2011;112:113
OSA Contributes to Post-Operative Complications

Perioperative Pulmonary Outcomes in Patients with Sleep Apnea After Noncardiac Surgery

Stavros Mentsoulis, MD, PhD, Spencer S. Liu, MD, Yan Ma, PhD, Ya Lin Chiu, MS, J. Matthias Walz, MD, Licia K. Gaber-Baylis, BA, and Madhu Mazumdar, PhD

Anesth Analg 2011;112:113-21

N = 6,051,703
43% orthopaedic
57% general surgical

Orthopedic Surgery

<table>
<thead>
<tr>
<th>Adverse Events</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration</td>
<td>0.84</td>
</tr>
<tr>
<td>ARDS</td>
<td>0.45</td>
</tr>
<tr>
<td>PE</td>
<td>0.42</td>
</tr>
<tr>
<td>Intubation</td>
<td>0.51</td>
</tr>
</tbody>
</table>

General Surgery

<table>
<thead>
<tr>
<th>Adverse Events</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration</td>
<td>2.06</td>
</tr>
<tr>
<td>ARDS</td>
<td>2.44</td>
</tr>
<tr>
<td>PE</td>
<td>0.49</td>
</tr>
<tr>
<td>Intubation</td>
<td>5.94</td>
</tr>
</tbody>
</table>

* indicates significant difference between no SA (matched sample) and SA (matched sample)
Mechanisms OSA → Respiratory Failure

Obesity and lung function
OSA & cardiovascular disease
OSA & ventilatory drive (O2 sensitive)
Drugs
Positioning
Peri-operative care (esp at night)
OSA & Upper airway (aka Difficult airway)
Difficult airway is associated with OSA

Difficult intubation = no glottic structure visible on laryngoscopy (Cormack & Lehane Grade 4).
N = 17 of 32 in 3 years
UnRx OSA -> $ Hospital Complications

$1000x

- Infective: 1.3
- Cardiovascular: 8
- Thromboembolic: 18
- Respiratory Failure: 52
Outline

- Evidence of OSA -> perioperative complications
- OSA pathophysiology & Rx
- Weaning from Intubation
Speech -> Snoring

Primate

Human
Airway collapsibility

- Weight

- Surfactant

- Size of airway

- UAW muscle tone (+/- oscillation=LG)

- Open

- Closed

- Snoring

- Hypopnoea

- Apnoea
Snoring
↓
Snoring with arousals
↓
Hypoponeas
↓
Obstructive Apnoeas
↓
Hypoventilation & high CO₂
↓
Advanced LV Heart failure
↓
Hyperventilation & low CO₂
↓
Cheyne Stokes Respiration
OSA & Cardiovascular Disease
Shamsuzzaman JAMA 2003;290:1906-14

- Obstructive Sleep Apnea
  - Hypoxemia
  - Reoxygenation
  - Hypercapnia
  - Intrathoracic Pressure Changes
  - Arousals

- Intermediary Mechanisms
  - Sympathetic Activation
    - Vasoconstriction
  - Increased Catecholamines
  - Tachycardia
  - Impaired Cardiovascular Variability
  - Endothelial Dysfunction
  - Vascular Oxidative Stress
  - Inflammation
  - Increased Coagulation
  - Metabolic Dysregulation
    - Leptin Resistance
    - Obesity
    - Insulin Resistance

- Risk of Cardiovascular Disease
  - Hypertension
  - Congestive Heart Failure
    - Systolic Dysfunction
    - Diastolic Dysfunction
  - Cardiac Arrhythmia
    - Bradycardia
    - A-V Block
    - Atrial Fibrillation
  - Cardiac Ischemia
    - Coronary Artery Disease
    - Myocardial Infarction
    - Nocturnal ST-Segment Depression
    - Nocturnal Angina
  - Cerebrovascular Disease
## Prevalence of Adult OSA in the Community

<table>
<thead>
<tr>
<th></th>
<th>Young. NEJM. 1993</th>
<th>Baldwin &amp; Young. 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snore</td>
<td>28%</td>
<td>44%</td>
</tr>
<tr>
<td>AHI &gt;5</td>
<td>9 → 25*</td>
<td>24 → 33**</td>
</tr>
<tr>
<td>AHI &gt;5 &amp; EDS</td>
<td>2 → ~6%</td>
<td>4 → ~8%</td>
</tr>
</tbody>
</table>

1993 Young  
Q = 3513; PSG = 602;  
2004 Baldwin  
F = 3398 & BMI=28.5  
M = 3042 & BMI=28.5
Mortality a OSA in USA (SHHS)
OSA Assessment

• Clinical
  – Anaesthetic or Dental: “Difficult airway”
  – Snore (without alcohol) with witnessed apnoeas
  – Mallampati 3 - 4
  – Neck Circumference (shirt collar > 43cm & ≥2 α HT drugs)
  – BMI >30

• Questionnaires
  – STOP-BANG
  – BERLIN

• Investigation
  – APNEALINK = finger oximetry, airflow & respiratory effort
  – POLYSOMNOGRAPHY
    • Home vs Laboratory
Mallampati classification

Original
(Anaesthetists)

Freidman
(Sleep physicians)

- Seated patient with head in neutral position
- Mouth wide open
- Protruded tongue
- No phonation
- No tongue depressor
## OSA Severity

<table>
<thead>
<tr>
<th></th>
<th>AHI (events/hour)</th>
<th>Minimum SpO2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;5</td>
<td>92-95</td>
</tr>
<tr>
<td>Mild</td>
<td>5-15</td>
<td>88-92</td>
</tr>
<tr>
<td>Moderate</td>
<td>15-30</td>
<td>80-88</td>
</tr>
<tr>
<td>Severe</td>
<td>30-120</td>
<td>50-80</td>
</tr>
</tbody>
</table>
Snoring vs AHI
Maimon et al JCSM 2010;6:475-78
Appendix 2: STOP-Bang Scoring Model

1. Snoring
   Do you snore loudly (louder than talking or 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/m²?
   Yes  No

6. Age
   Age over 50 yr old?
   Yes  No

7. Neck circumference
   Neck circumference greater than 40 cm?
   Yes  No

8. Gender
   Gender male?
   Yes  No

**High risk of OSA:** answering yes to three or more items

**Low risk of OSA:** answering yes to less than three items
Berlin Questionnaire (+ve ≥2 categories)


<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>Age</th>
<th>Male / Female</th>
</tr>
</thead>
</table>

Please choose the correct response to each question.

**Category 1**

1. Do you snore?
   - a. Yes
   - b. No
   - c. Don’t know

2. Your snoring is:
   - a. Slightly louder than breathing
   - b. As loud as talking
   - c. Louder than talking
   - d. Very loud – can be heard in adjacent rooms

3. How often do you snore?
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

4. Has your snoring ever bothered other people?
   - a. Yes
   - b. No
   - c. Don’t Know

5. Has anyone noticed that you quit breathing during your sleep?
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

**Category 2**

6. How often do you feel tired or fatigued after your sleep?
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

7. During your waking time, do you feel tired, fatigued or not up to par?
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?
   - a. Yes
   - b. No

**If yes:**

9. How often does this occur?
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

**Category 3**

10. Do you have high blood pressure?
    - Yes
    - No
    - Don’t know

---

**Scoring Berlin questionnaire**


The questionnaire consists of 3 categories related to the risk of having sleep apnea. Patients can be classified into High Risk or Low Risk based on their responses to the individual items and their overall scores in the symptom categories.

**Categories and scoring:**

**Category 1:** items 1, 2, 3, 4, 5.

- Item 1: if ‘Yes’, assign 1 point
- Item 2: if ‘c’ or ‘d’ is the response, assign 1 point
- Item 3: if ‘a’ or ‘b’ is the response, assign 1 point
- Item 4: if ‘a’ is the response, assign 1 point
- Item 5: if ‘a’ or ‘b’ is the response, assign 2 points

Add points. **Category 1** is positive if the total score is 2 or more points.

**Category 2:** items 6, 7, 8 (item 9 should be noted separately).

- Item 6: if ‘a’ or ‘b’ is the response, assign 1 point
- Item 7: if ‘a’ or ‘b’ is the response, assign 1 point
- Item 8: if ‘a’ is the response, assign 1 point

Add points. **Category 2** is positive if the total score is 2 or more points.

**Category 3** is positive if the answer to item 10 is ‘Yes’ OR if the BMI of the patient is greater than 30 kg/m².

(BMI must be calculated. BMI is defined as weight (kg) divided by height (m) squared, i.e., kg/m²).

**High Risk:** if there are 2 or more Categories where the score is positive

**Low Risk:** if there is only 1 or no Categories where the score is positive
## OSA Management

<table>
<thead>
<tr>
<th>Age</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child:</td>
<td>Surgery &gt; Dental &gt; Lifestyle</td>
</tr>
<tr>
<td>Adult:</td>
<td>Lifestyle &gt; CPAP &gt; Dental</td>
</tr>
<tr>
<td>Elderly:</td>
<td>CPAP &gt;&gt; Dental &amp; Lifestyle</td>
</tr>
</tbody>
</table>
OSA Treatment: Conservative - Lifestyle

- Weight loss
- “Cautious” alcohol
- One pillow (avoid neck flexion)
- Raise head of bed 10-15cm (avoid UAW oedema)
- Sleep in lateral (recovery) position (chin extension)
- Reduce nasal resistance (HDM, Nasal Steroids)
- Minimize medications (steroids, sedatives, antiseizure)
- Avoid sleep deprivation
- Avoid fluid accumulation in legs
# Medical & Surgical Wt Loss


<table>
<thead>
<tr>
<th>Method</th>
<th>Weight*</th>
<th>AHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical</td>
<td>154 → 101</td>
<td>54 → 19</td>
</tr>
<tr>
<td>Medical</td>
<td>106 → 92</td>
<td>23 → 12</td>
</tr>
</tbody>
</table>

* Assume height 174 cm

80-90% of patients still have AHI > 5
Tonsils and adenoids

Sinus and turbinectomy

Retrognathia

UPPP

Maxillary restriction

High Arched Palate

Surgery?
Dental

Mandibular Advancement

Maxillary Expansion
# CPAP Family

<table>
<thead>
<tr>
<th>Nasal Masks</th>
<th>Nasal Pillows Masks</th>
<th>Full Face Masks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisher &amp; Paykel 405</td>
<td>Fisher &amp; Paykel 406</td>
<td>Fisher &amp; Paykel Forma (Replaces the F&amp;P 401, 433)</td>
</tr>
<tr>
<td>Philips Respironics Comfort Full</td>
<td>Philips Respironics Comfort Gel</td>
<td>Covidien Puritan Bennett Breeze</td>
</tr>
<tr>
<td>Philips Respironics Profile Lite</td>
<td>Covidien Puritan Bennett DreamFit</td>
<td>Philips Respironics Comfort Full Gel</td>
</tr>
<tr>
<td>Covidien Sandman Intro</td>
<td>Covidien Sandman Info</td>
<td>Fisher &amp; Paykel SleepStyle HC244</td>
</tr>
<tr>
<td>Covidien Sandman Auto</td>
<td>Fisher &amp; Paykel Healthcare HC508</td>
<td>Fisher &amp; Paykel Healthcare HC254</td>
</tr>
</tbody>
</table>

- **ResMed S8 Lightweight** with optional H4i Humidifier
- **ResMed S8 Auto-Score II Platinum** with optional H4i Humidifier
- **ResMed S8 Auto-Set Spirit II Platinum** with optional H4i Humidifier
- **Philips Respironics M Series REMstar Plus** shown with optional humidifier
- **Philips Respironics M Series REMstar Pro** shown with optional humidifier
- **Philips Respironics M Series REMstar Auto** shown with optional humidifier
- **Covidien Sandman Intro**
- **Covidien Sandman Info**
- **Covidien Sandman Auto**
- **Fisher & Paykel Healthcare HC508**
- **Fisher & Paykel SleepStyle HC244**
- **Fisher & Paykel Healthcare HC254**
- **Philips Respironics Comfort Fusion**
- **Philips Respironics Comfort Gel**
- **Covidien Puritan Bennett Breeze**
- **Philips Respironics Profile Lite**
- **Covidien Puritan Bennett DreamFit**
- **Covidien Puritan Bennett DreamSeal**
- **ResMed Liberty**
Long term adherence to CPAP

McArdle AJRCCM 1999;159:1108

N=1211
Symptom & AHI >5 (?)
Mean f-up 22 months
8 cmH2O x 5.6hrs
BMI 30

Figure 1. Percentage of patients using CPAP versus time.
Outline

• Evidence of OSA -> perioperative complications
• OSA pathophysiology & Rx
• Weaning from Intubation
1. Cardiac Surgery & Post-op CPAP [OSA undefined]

- oxygen toxicity
- diaphragm weakness
  - trauma
  - bypass

Prophylactic Nasal Continuous Positive Airway Pressure Following Cardiac Surgery Protects From Postoperative Pulmonary Complications*

A Prospective, Randomized, Controlled Trial in 500 Patients

Alexander Zarbock, MD; Eckhard Mueller, MD; Sabine Nätzer, MD; Andrea Gabriel, MD; Peter Feindt, MD; and Detlef Kindgen-Milles, MD

**Background:** Continuous positive airway pressure is a noninvasive respiratory support technique that may prevent pulmonary complications following cardiac surgery. This study was conducted to determine the efficacy of prophylactic nasal continuous positive airway pressure (nCPAP) compared with standard treatment. The primary end points were pulmonary adverse effects defined as hypoxemia (PaO₂/fraction of inspired oxygen [FIO₂] <100), pneumonia, and reintubation. The secondary end point was the readmission rate to the ICU or intermediate care unit (IMCU).

**Methods:** We prospectively randomized 500 patients scheduled for elective cardiac surgery. Following extubation either in the operating room (early) or in the ICU (late), patients were allocated to standard treatment (control) including 10 min of intermittent nCPAP at 10 cm H₂O every 4 h or prophylactic nCPAP (study) at an airway pressure of 10 cm H₂O for at least 6 h.

**Results:** Prophylactic nCPAP significantly improved arterial oxygenation (PaO₂/FIO₂) without altering heart rate and mean arterial BP. Pulmonary complications including hypoxemia (defined as PaO₂/FIO₂ <100), pneumonia, and reintubation rate were reduced in study patients compared to controls (12 of 232 patients vs 25 of 236 patients, respectively; p = 0.03). The readmission rate to the ICU or IMCU was significantly lower in nCPAP-treated patients (7 of 232 patients vs 14 of 236 patients, respectively; p = 0.03).

**Conclusions:** The long-term administration of prophylactic nCPAP following cardiac surgery improved arterial oxygenation, reduced the incidence of pulmonary complications including pneumonia and reintubation rate, and reduced readmission rate to the ICU or IMCU. Thus noninvasive respiratory support with nCPAP is a useful tool to reduce pulmonary morbidity following elective cardiac surgery.

(CHEST 2009; 136:1292–1299)
1. Methods—Cardiac Surgery & Post-op CPAP


LATE EXTUBATION = 6 hours later

CONTROL = CPAP 10 x 10 min 4 hourly

“STUDY” = CPAP 10 > 6 hours
Early extub = 14.6 hours
Late extub = 9.1 hours

500 patients enrolled
and
32 patients excluded
(secondary bleeding (13), perioperative left ventricular failure with catecholamine treatment (11), perioperative myocardial ischemia (3), mechanical ventilation > 18h (3), and insufficient documentation (2)).

292 patients late extubated
176 patients early extubated

Study group
146 patients

Control group
146 patients

Study group
86 patients

Control group
90 patients

Figure 1. Patient flow chart.
1. Results - Cardiac Surgery & Post-op CPAP

<table>
<thead>
<tr>
<th>Complications</th>
<th>CPAP</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary *</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Cardiac</td>
<td>81</td>
<td>92</td>
</tr>
<tr>
<td>ICU Readmission *</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>LOS ICU (hrs)</td>
<td>27</td>
<td>26</td>
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Use of non-invasive ventilation to wean critically ill adults off invasive ventilation: meta-analysis and systematic review

Karen E A Burns, Neill K J Adhikari, Sean P Keenan and Maureen Meade

BMJ 2009;338:b1574;
doi:10.1136/bmj.b1574

Study selection criteria We searched Medline, Embase, and CENTRAL, proceedings from four conferences, and reference lists of relevant studies to identify relevant trials. Two reviewers independently selected trials, assessed trial quality, and abstracted data.

Results We identified 12 trials enrolling 530 participants, mostly with chronic obstructive pulmonary disease. Compared with invasive weaning, non-invasive weaning was significantly associated with reduced mortality (relative risk 0.55, 95% confidence interval 0.38 to 0.79), ventilator associated pneumonia (0.29, 95% CI 0.19 to 0.45), length of stay in intensive care unit (weighted mean difference −6.27 days, −8.77 to −3.78) and hospital (−7.19 days, −10.80 to −3.58), total duration of ventilation, and duration of invasive ventilation. Non-invasive weaning had no effect on weaning failures or weaning time. Benefits on mortality and weaning failures were non-significantly greater in trials that exclusively enrolled patients with chronic obstructive pulmonary disease versus mixed populations.

Conclusions Current trials in critically ill adults show a consistent positive effect of non-invasive weaning on mortality and ventilator associated pneumonia, though the net clinical benefits remain to be fully elucidated. Non-invasive ventilation should preferentially be used in patients with chronic obstructive pulmonary disease in a highly monitored environment.
Q: 46yo male, BMI=35, smoker, single, loud snorer, 2 drug hypertension, myocardial infarct 12 mths ago, Presents for semi-urgent CAGS?
Peri-operative Management?

• Pre-operative:
  – if elective operation & on CPAP – bring to hospital
  – if drowsy & aspiration risk, change full face to nasal mask
  – if moderate to severe untreated OSA & due for elective major surgery, refer for sleep assessment pre-op.

• Post-operative:
  – high risk untreated / undiagnosed OSA – treat with CPAP
  – monitor patient with educated staff (see table next slide)
  – refer for sleep assessment if not previously diagnosed.
## Post-operative “Nursing” - Alfred

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Outline

• Evidence of OSA -> perioperative complications
• OSA pathophysiology & Rx
• Weaning from Intubation
Outline

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