Sleep Apnea and Difficulty in Extubation

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25th Annual Congress &
18th French Lebanese Symposium

Introduction

- Repetitive collapse of the upper airway
  - sleep fragmentation,
  - hypoxemia, hypercapnia,
  - marked variations in intrathoracic pressures
  - increased sympathetic activity
- Increased perioperative risk and postoperative complications
- Main problem : only 20% of individuals with OSA are identified

Patho-physiology

Sleep ➔ pharyngeal musculature relaxation

Balance between UA muscle activity and negative pressure generated in airway

Progressive UA closure ➔ complete obstruction (apnea) or partial obstruction (hypopnea) during REM sleep

Hypercapnia and acidosis resulting from hypoventilation stimulate arousal centers

Prevalence

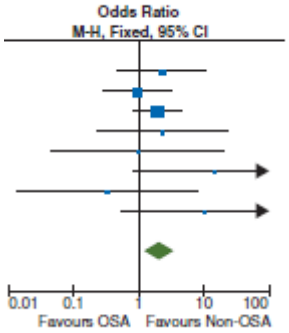
- Prevalence of sleep-disordered breathing was estimated as **9% for women and 24%** for **men** 30 and 60 yrs.
- **24% of people older than 65 years**. up to 50% of nursing home residents Young T, Am J Respir Crit Care Med. 2002;165:1217–1239
- In bariatric surgery of obese patients, the prevalence was as high as 70% Lopez PP, Am Surg. 2008;74:834–838.
- Before bariatric surgery, out of 661 patients, 534 of (81%) had not been diagnosed for OSA at the time of surgery O'Keeffe T, Obes Surg. 2004;14:23–6.

Complications

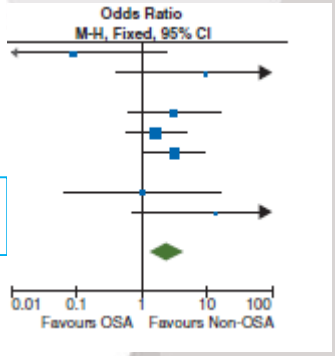
- In OSA patients (prone to UA closure**), anesthetic agents may produce an airway obstruction** that is not necessarily correlated to the level of sedation.
- **In the early phase** (24-48 h), complications arise due to the negative effects of sedative, analgesic, and anesthetic agents on pharyngeal tone and on the arousal responses to hypoxia, hypercarbia, and obstruction.
- **In the late phase** (after one week) complications are mainly due to a “rebound” of REM phase due to the administration of high doses of opioids in postoperative care, that suppress REM phase thus causing sleep deprivation

Meta-analysis R. Kaw British Journal of Anaesthesia 109 (6): 897–906 (2012)

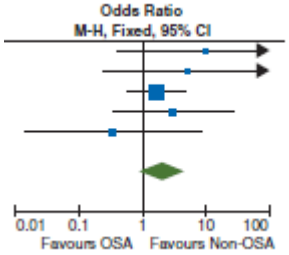
Any cardiac events



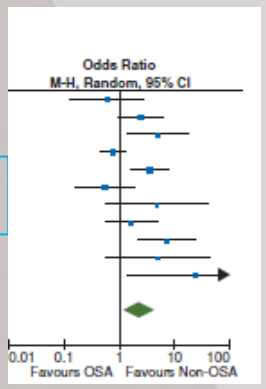
Postoperative respiratory failure



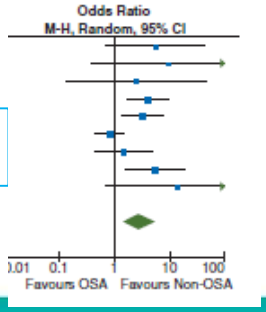
Reintubation



Postoperative desaturation



Postoperative ICU transfer



Preoperative predictors of difficult intubation in patients with obstructive sleep apnea syndrome

TABLE II Demographics of OSAS patients with or without difficult endotracheal intubation

Variables	*OSAS patients with difficult intubation (n = 15)*	*OSAS patients without difficult intubation (n = 75)*	*P value*
Age (yr)	46.1 ± 9.2	43.6 ± 9.9	0.378
Height (cm)	167.9 ± 5.3	169.0 ± 5.6	0.482
Weight (kg)	78.8 ± 9.9	79.5 ± 9.3	0.776
BMI (kg·m^2)	28.0 ± 3.9	27.8 ± 2.6	0.808
Hb >15 g·dL (%)	46.7	68.5	0.188
AHI (n·hr^{-1})	67.4 ± 22.5	49.9 ± 28.0	0.026*
LSAT-PREOP (%)	72.7 ± 10.7	77.2 ± 10.2	0.141
Extubation time (min)	11.7 ± 3.1	9.5 ± 1.1	0.064
Length of stay in PACU (min)	79.6 ± 18.0	77.8 ± 17.7	0.706
LSAT-PACU (%)	95.0 ± 3.2	96.0 ± 1.3	0.057

OSAS = obstructive sleep apnea syndrome, AHI = apnea-hypopnea index; BMI = body mass index; Hb = hemoglobin; PACU = postanesthesia care unit; LSAT-PACU = lowest saturation in the postanesthesia care unit; LSAT-PREOP = preoperative lowest saturation. *$P < 0.05$.

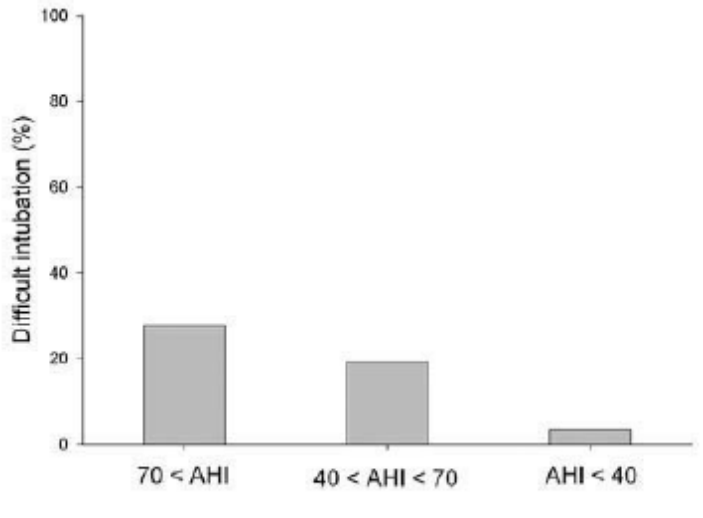
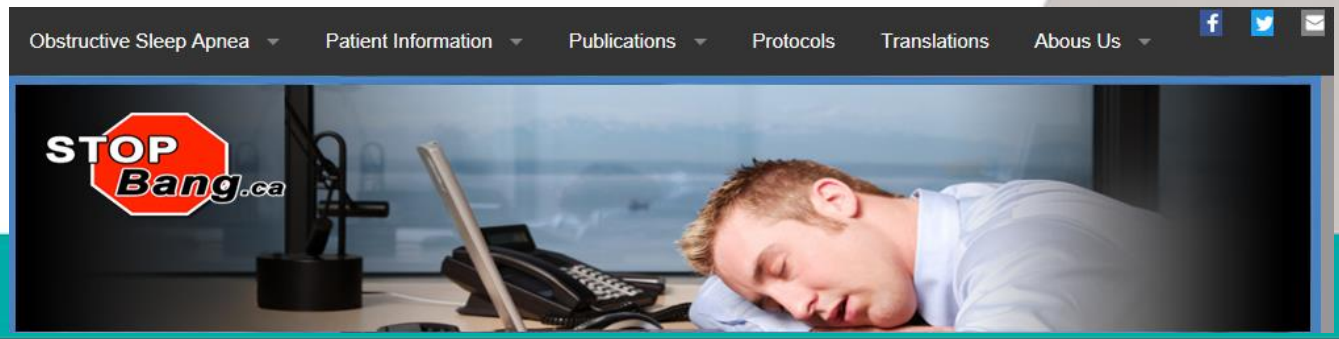


FIGURE Difficult intubation in obstructive sleep apnea syndrome (OSAS) according to apnea-hypopnea index AHI ($P = 0.039$).

Jie Ae Kim CAN J ANESTH 2006 / 53: 4 / pp 393–397

Diagnosis of Obstructive Sleep Apnea

- The reference standard for diagnosis of OSA is an overnight polysomnogram (at home ?)
  - moderate OSA = apnea-hypopnea ➔ index AHI > 15
  - Severe OSA ➔ AHI > 30
  - **Time-consuming & long waiting lists**
- 60% of surgical patients with moderate to severe OSA were not recognized or diagnosed preoperatively Singh M, Br J Anaesth. 2013;110(4):629-636.
- (STOP-Bang) questionnaire was developed to meet the need for a reliable, concise, and easy-to-use screening tool



STOPBang Questionnaire

Is it possible that you have ...
Obstructive Sleep Apnea (OSA)?

Please answer the following questions below to determine if you might be at risk.

Yes ○ No ○

Snoring ?

Do you **Snore Loudly** (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?

Yes ○ No ○

Tired ?

Do you often feel **Tired, Fatigued, or Sleepy** during the daytime (such as falling asleep during driving or talking to someone)?

Yes ○ No ○

Observed ?

Has anyone **Observed** you **Stop Breathing** or **Choking/Gasping** during your sleep ?

Yes ○ No ○

Pressure ?

Do you have or are being treated for **High Blood Pressure** ?

Yes ○ No ○ **Body Mass Index more than 35 kg/m^2?**

Body Mass Index Calculator

○ cm / kg ○ inches / lb

Height: Weight:

Calculate

BMI:

Yes ○ No ○ **Age older than 50 ?**

Yes ○ No ○ **Neck size large ? (Measured around Adams apple)**

For male, is your shirt collar 17 inches / 43cm or larger?
For female, is your shirt collar 16 inches / 41cm or larger?

Yes ○ No ○ **Gender = Male ?**

See Result

For general population

OSA - Low Risk : Yes to 0 - 2 questions
OSA - Intermediate Risk : Yes to 3 - 4 questions
OSA - High Risk : Yes to 5 - 8 questions
or Yes to 2 or more of 4 STOP questions + male gender

STOP-Bang Questionnaire

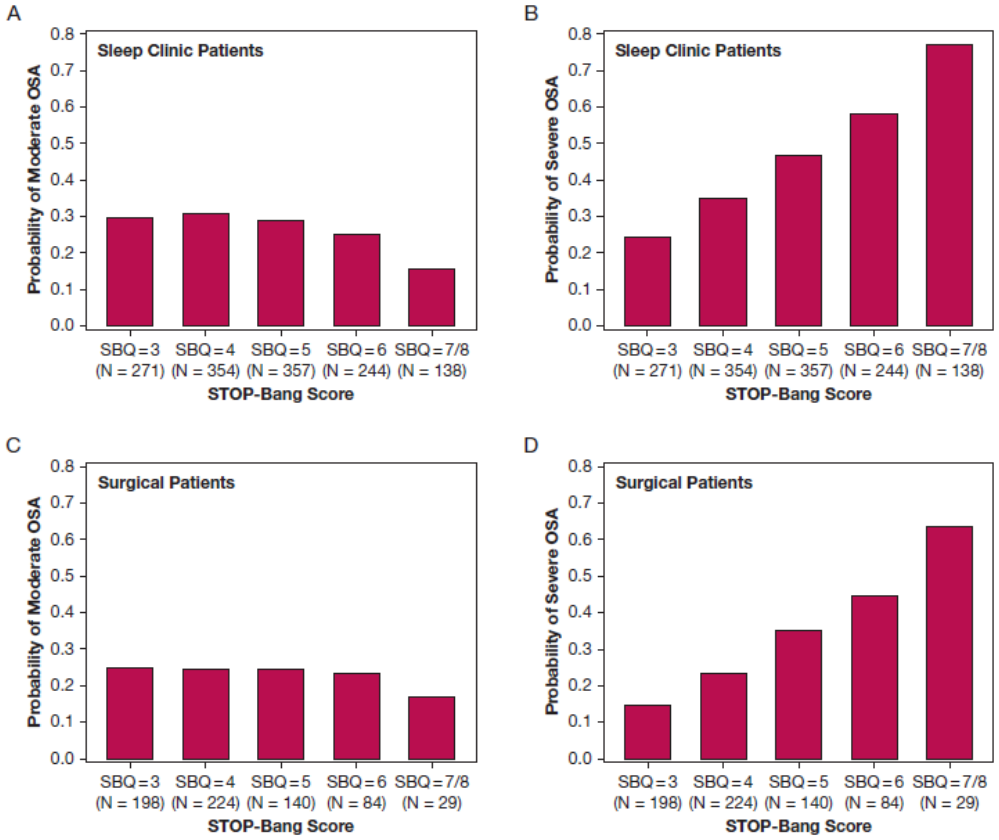


Figure 1 – *Relationship between SBQ score and the probability of OSA. A, SBQ score and probability of moderate OSA (apnea-hypopnea index [AHI] > 15-30) in sleep clinic patients. B, SBQ score and probability of severe OSA (AHI > 30) in sleep clinic patients. C, SBQ score and probability of moderate OSA (AHI > 15-30) in surgical patients. D, SBQ score and probability of severe OSA (AHI > 30) in surgical patients. (A) and (B) are based on the meta-analysis of two studies in sleep clinics.[21,43] (C) and (D) are based on the meta-analysis of two studies in surgical patients.[32,33] SBQ = STOP-Bang questionnaire; STOP-Bang = snoring, tiredness, observed apnea, high BP, BMI, age, neck circumference, and male gender.*

F Chung CHEST 2016; 149(3):631-638

STOP-Bang Questionnaire

TABLE 2] Predictive Performance of Combination of Two Items From STOP and One From Bang for Identifying Patients With Moderate to Severe Obstructive Sleep Apnea (Apnea-Hypopnea Index > 15)

Cutoff	Sensitivity	Specificity	PPV	NPV
STOP-Bang ≥ 3	87.3 (81.8-91.6)	30.7 (25.7-36.1)	43.8 (38.8-48.8)	79.7 (71.5-86.4)
STOP ≥ 2 + Bang ≥ 1	71.6 (64.7-77.8)	46.1 (40.5-51.7)	45.0 (39.5-50.7)	72.4 (65.7-78.4)
STOP ≥ 2 + BMI > 35 kg/m^2	20.8 (15.4-27.2)	85.0 (80.6-88.7)	46.1 (35.4-57.0)	63.5 (58.7-68.0)
STOP ≥ 2 + Neck > 40 cm	33.5 (27.0-40.6)	79.0 (74.1-83.3)	49.6 (40.8-58.4)	65.8 (60.8-70.5)
STOP ≥ 2 + male gender	40.1 (33.2-47.3)	76.8 (71.8-81.3)	51.6 (43.4-59.8)	67.5 (62.4-72.3)
STOP ≥ 2 + age > 50 y	59.4 (52.2-66.3)	56.1 (50.5-61.6)	45.5 (39.3-51.8)	69.1 (63.1-74.7)

Data are presented as average (95% CI). Bang = BMI, age, neck circumference, and male gender; NPV = negative predictive value; PPV = positive predictive value; STOP = snoring, tiredness, observed apnea, and high BP. (Adapted with permission Chung et al.[43])

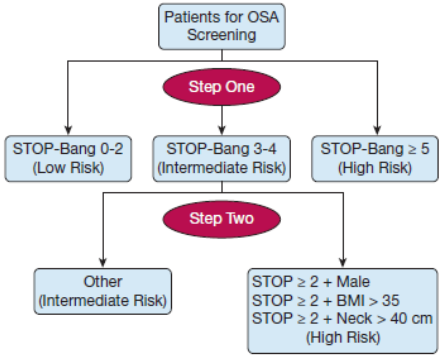


Figure 2 – *STOP-Bang algorithm with a two-step scoring strategy. See Figure 1 legend for expansion of abbreviation.*

None of these questionnaires are particularly useful in excluding mild OSA (AHI 5 to 15).

Frances Chung CHEST 2016; 149(3):631-638

STOP-Bang Questionnaire

Prediction of difficult intubation HV Acar 2014; 18: 1869-1874

Statistics	Definitions	STOP-Bang
Cut-off point		≥3
No. of cases	N	200
Sensitivity	TP/(TP+FN)	11/14 (78.6%)
Specificity	TN/(TN+FP)	114/186 (61.3%)
PPV	TP/(TP+FP)	11/83 (13.3%)
NPV	TN/(TN+FN)	114/117 (97.4%)
Accuracy	(TP+TN)/N	125/200 (62.5%)
OR	(95%CI)	5.806 (1.566-21.522)
p-value		0.004

The STOP-BANG score does not predict hypoxaemia in adults recovering from noncardiac surgery A. K. Khanna British Journal of Anaesthesia, 116 632–40 (2016)

Anesthetic agents

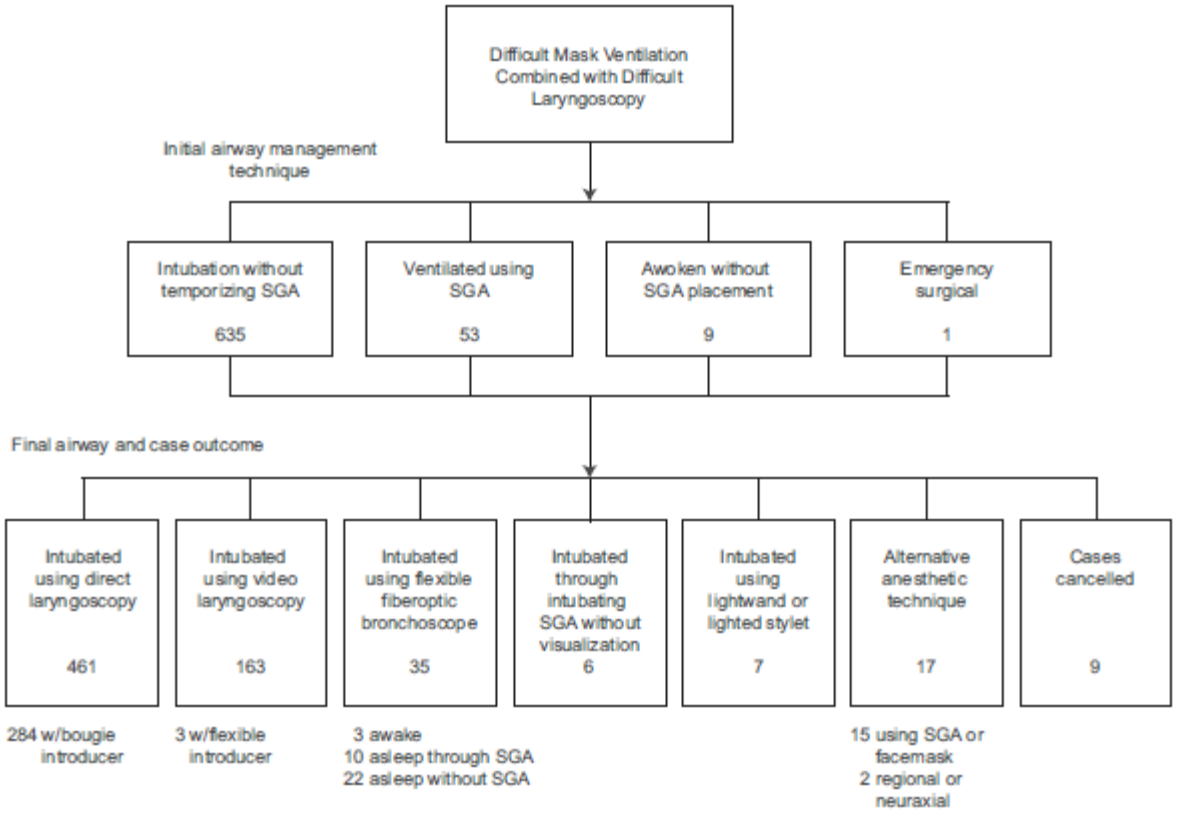
- **No anxiolytic premedication**
- Oral clonidine premedication may reduce the amount of intraoperative anesthetics and postoperative opioids
- Regional anesthesia may avoid or reduce the need for sedative drugs and opioids during all the perioperative period
- All agents caused some degrees of airway collapse. Dexmedetomidine did not have dose-dependent effects Ehsan Z Laryngoscope 2016 Jan;126(1):270-84
- Dexmedetomidine
  - Dexmedetomidine provided greater hemodynamic stability and less respiratory depression than propofol Yoon BW Laryngoscope 2016 Mar;126(3):763-7
  - Sedation during MRI Richa F J Clin Anesth. 2015 Dec;27(8):698-9.

Airway management

- **Pre-oxygenation**
  - > Sitting position 30° + Pressure support ventilation = 4 cm H_2O
- **Difficult face mask ventilation + difficult intubation**

S. Kheterpal
Anesthesiology 12 2013,
Vol.119, 1360-1369

- 4 institutions
- 176,679 cases
- 698 patients DI DFMV
- Incidence 0,4%



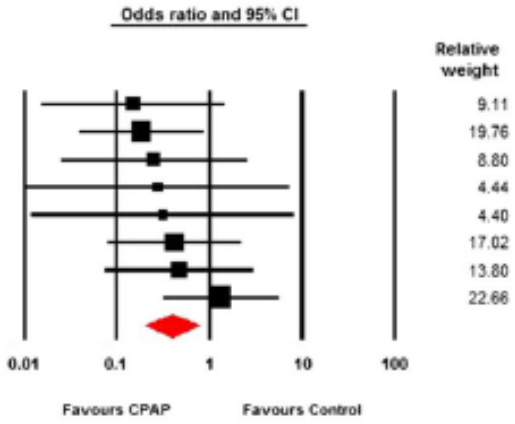
Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea

- When feasible, **CPAP or noninvasive positive pressure ventilation** (with or without supplemental oxygen) should be continuously administered to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure.
- If possible, patients at increased perioperative risk from OSA should be placed in **nonsupine positions** throughout the recovery process.
- Hospitalized patients who are at increased risk of respiratory compromise from OSA should have **continuous pulse oximetry monitoring after discharge** from the recovery room.
- Continuous monitoring should be maintained as long as patients remain at increased risk.

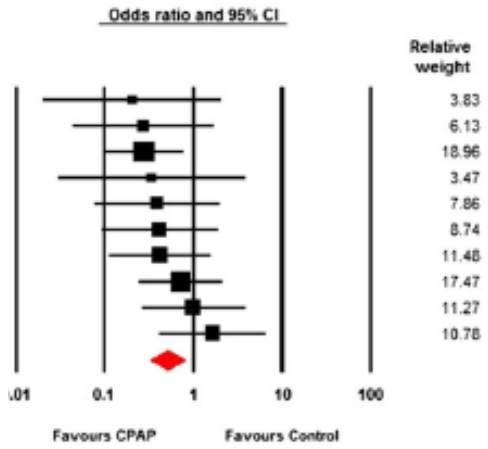
Anesthesiology. **2014** Feb;120(2):268-86.

Optimizing Prophylactic CPAP in Patients Without Obstructive Sleep Apnoea for High-Risk Abdominal Surgeries: A Meta-regression Analysis

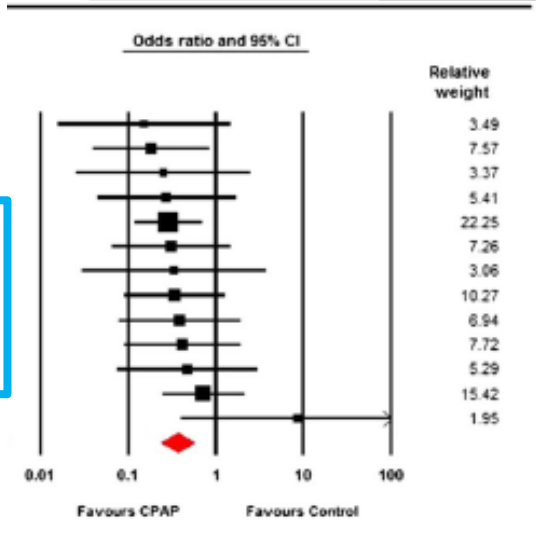
Pneumonia



Atelectasis



Postoperative pulmonary complications



Singh P Lung. 2016 Apr;194(2):201-17M

Metaanalysis : CPAP vs nonCPAP
Postoperative adverse events in OSA patients

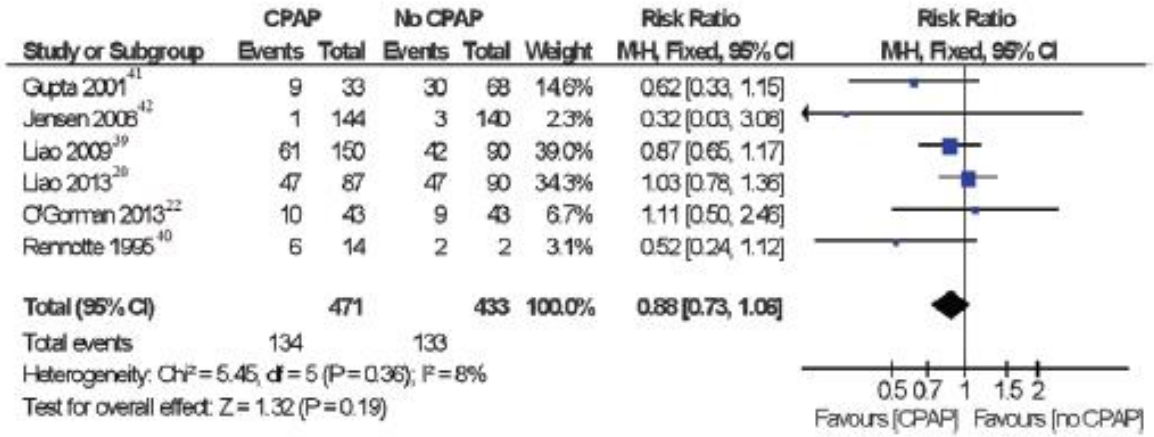


Figure 4. Forest plot of the association of postoperative adverse events in obstructive sleep apnea patients with continuous positive airway pressure (CPAP) versus no-CPAP treatment. CI = confidence interval; Chi² = χ^2 test; *df* = degrees of freedom.

Table 5. Data on AHI

First author, reference no.	Preoperative AHI			Postoperative AHI			
	N	Mean ± SD	Median (range)	*N*	Mean ± SD	Median (range)	*P*
Liao[20]	87	34 ± 17	30 (15–104)	40	10 ± 17	3 (0.0–83)	<0.001
Rennotte[40]	13	55 ± 22	59 (23–89)	11	18 ± 13	16 (4–49)	<0.001
Total	100	37 ± 19	32 (15–104)	51	12 ± 16	5 (0–83)	<0.001

Data presented as median (range) or mean ± SD.
AHI = Apnea-Hypopnea Index.

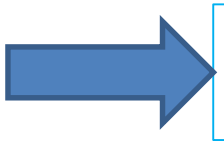
Conclusions

- **Anesthesiologists have to identify patients with obstructive sleep apnea**

- Postoperative SpO_2 monitoring to ensure that they are not obstructing their airway and becoming hypoxic.
  - Where ? ICU, ward ?
  - Alarm ?

- Severe OSA and obesity hypoventilation syndrome should be treated with CPAP but for some patients, it is not an easy therapy.

- Morbidity and mortality in adult and paediatric patients with OSA is well-documented and poor postoperative surveillance features in many of these cases
- Prevalence is high = 1 in every 4 men and 1 in every 10 women
- Incidence of these severe complications is low
- Using the HDU bed for the OSA patient may deprive other patients of that resource



Difficult choice

Postoperative complications

- Matched controls patients(101) without OSAS undergoing orthopedic surgery
- Complications were significantly more frequent in patients with OSA (39%) than in control patients (18%)
- Admission to ICU for cardiac ischemia or respiratory failure were significantly higher in OSA patients (24%) *versus* 9% of controls.
- Longer Hospital length of stay

Gupta RM, Mayo Clin Proc. 2001;76:897–905.

Chung F, Liao P, Elsaid H, Islam S, Shapiro CM, Sun Y. Oxygen desaturation index from nocturnal oximetry: a sensitive and specific tool to detect sleep-disordered breathing in surgical patients.
Anesth Analg. 2012 May;114(5):993–1000

The ODI >10 demonstrated a sensitivity of 93% and a specificity of 75% in the detection of moderate and severe SDB

NAP4 study

- To track major airway complications : death, brain damage, need for surgical airway, and unplanned ICU admission,
- 38 events that occurred at emergence or during recovery from anesthesia were (0.001%) over 2,872,600 general anesthetics performed yearly in the UK (1 major airway adverse event postextubation in 75,600 anesthetics).
- Comorbidities were :
  - Obesity (46%),
  - Chronic obstructive pulmonary disease (34 %),
  - Obstructive sleep apnea (OSA;13%),

Death or Neurologic Injury after Tonsillectomy in Children with a Focus on Obstructive Sleep Apnea: Houston, We Have a Problem!

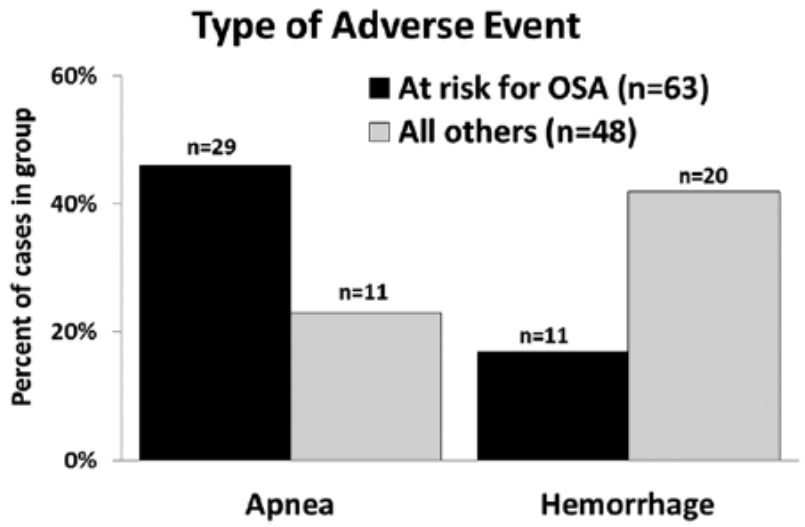


Figure 2. A larger proportion of at risk for obstructive sleep apnea (OSA) children had the event attributed to apnea (P = 0.016) whereas all others had a larger proportion of events attributed to hemorrhage (P = 0.006). P-values by Fisher exact test.

- 111 cases.
- Death and permanent neurologic injury in 86 (77%) cases
- Operating room, postanesthesia care unit, on the ward, and at home.

C Cote Anesth Analg 2014;118:1276–83