



# Malaysian Guidelines for the Peri-operative Care of Adults with Obstructive Sleep Apnoea

Published by  
College of Anaesthesiologists, Academy of Medicine of Malaysia  
Malaysian Society of Anaesthesiologists

August 2018

# Malaysian Guidelines for the Peri-operative Care of Adults with Obstructive Sleep Apnoea

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#### **DISCLAIMER**

This is a consensus document developed by a panel comprised of multidisciplinary experts on this topic. The contents of these guidelines are based on currently available scientific evidence and clinical experience. This practice guideline is not intended to define standards of care or represent absolute requirements for patient care. Clinical individual judgements by the responsible physicians are still of paramount importance in the management of individual cases.

This document is written to address the assessment and management of patients with obstructive sleep apnoea who are to undergo an operation.

# CONTENTS

<b>Introduction</b>	<b>4</b>
<b>Peri-operative Care of Adults with Obstructive Sleep Apnoea</b>	
<b>1. Pre-operative Screening of Patients with Obstructive Sleep Apnoea</b>	<b>5</b>
<b>2. Intra-operative Management of Patients with Obstructive Sleep Apnoea</b>	<b>13</b>
<b>3. Post-operative Management of Patients with Obstructive Sleep Apnoea</b>	<b>16</b>
<b>Peri-operative Care of Adults with Obstructive Sleep Apnoea</b>	
<b>Annexure 1 - Suspected OSA</b>	<b>20</b>
<b>Annexure 2 - Documented OSA</b>	<b>21</b>
<b>References</b>	<b>22</b>

## INTRODUCTION

Sleep disturbance is a very common condition observed in the community. Lack of sleep or disturbed sleep often results in impaired daytime performance, hypersomnolence, irritability and increased risk of accidents. In addition, prolonged sleep disturbance can adversely affect an individual's health.<sup>1-3</sup>

**O**bststructive Sleep Apnoea (OSA) is the most common sleep disordered breathing.<sup>4</sup> It is highly prevalent and often under diagnosed. In North America it is estimated that the prevalence of OSA is approximately 34% in men aged 30-70 years and 17% in women aged 30-70 years.<sup>5</sup> In Europe the reported incidence of moderate to severe OSA is estimated to be 23% in woman and 49% in men.<sup>6</sup> Recent study showed that the prevalence of moderate to severe OSA in a multiethnic Asian population in Singapore is around 30%.<sup>7</sup> Because of the aging of the population and the increasing in obesity epidemic, OSA is expected to become more prevalent.

Emerging epidemiological data suggest that obstructive sleep apnoea (OSA) is also common in the general surgical population. It is likely to be higher than the general population with an incidence as high as 70% in the select population (e.g. bariatric surgical patients).<sup>8-10</sup> Unfortunately, >80% of these patients are unrecognised and untreated at the time of surgery.<sup>11-13</sup> Many studies have shown that patients with OSA are at higher risk of peri-operative complications.<sup>14-17</sup>

This document is written to address the assessment and management of patients with obstructive sleep apnoea who are to undergo an operation.

# 1. PRE-OPERATIVE SCREENING OF PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

## 1.1 What is obstructive sleep apnoea (OSA)?

- It is characterised by recurrent episodes of complete or partial airway obstruction and abnormal breathing during sleep. These episodes are accompanied by arterial oxygen desaturation and bursts of sympathetic over-activation provoking surges in blood pressure and heart rate. They are usually terminated by brief cortical arousals.<sup>5,6</sup>

## 1.2 What are the signs and symptoms associated with OSA?

- Its symptoms can be divided into those that occur during sleep (nocturnal symptoms) and those manifested in the awake state (daytime symptoms)
- Nocturnal symptoms<sup>18,19</sup> include:
  - Snoring
  - Choking and gasping during sleep
  - Bad dreams
  - Witnessed apnoea
  - Nocturia
  - Frequent arousals
  - Night time sweating
- Daytime symptoms<sup>18,19</sup> include:
  - Hypersomnolence
  - Daytime tiredness
  - Poor concentration/memory
  - Early morning headache/dizziness
  - Mood disturbances (anxiety or depression)

## 1.3 What are the consequences of OSA?

- OSA may lead to many adverse outcomes:<sup>20-26</sup>
  - Cerebrovascular events

- Cerebrovascular accident
- Cardiovascular events
  - Hypertension, cardiac arrhythmia, ischaemic heart disease pulmonary hypertension, congestive heart failure, arrhythmias and sudden cardiac death
- Metabolic consequences
  - Diabetes mellitus
- Psychological health
  - Depression
- Increased risk of accidents

#### 1.4 What are the risk factors associated with OSA?

- Numerous risk factors have been shown to increase the risk and severity of OSA which include:
  - Age (>40 years old)<sup>27,28</sup>
  - Male gender<sup>29,30</sup>
  - Menopause<sup>30,31</sup>
  - Craniofacial abnormalities<sup>32</sup>
    - Micrognathia
    - Retrognathia
    - Overjet and overbite of teeth
    - Macroglossia
    - Large uvula, tonsils and adenoid tissue
    - Thick (increase neck circumference) and short neck
  - Obesity<sup>33</sup>
  - High Mallampati score<sup>34</sup>
  - Smoking and alcohol consumption<sup>35</sup>

#### 1.5 How is OSA diagnosed?

- Suspected OSA is usually confirmed by a standard diagnostic test of polysomnography, which measures the number of episodes of apnoea and hypopnoea per hour during sleep.

- The American Academy of Sleep Medicine [AASM] defines the severity of OSA based on the following criteria:<sup>36</sup>
  - Mild OSA - AHI 5 - <15 events/hour
  - Moderate OSA - AHI 15 - 30 events/hour
  - Severe OSA - AHI >30 events/hour
- *Apnoea-Hypopnoea Index (AHI)* is an index used to indicate the severity of sleep apnea. It is represented by the number of apnoea and hypopnea events per hour of sleep. The apnoea (pauses in breathing) must last for at least 10 seconds and be associated with a decrease in oxyhemoglobin saturation for ≥4% from baseline.
- Combining AHI and oxygen desaturation gives an overall sleep apnoea severity score that evaluates both the number of sleep disruptions and the degree of oxygen desaturation (low oxygen level in the blood).

## 1.6 What are the objectives of these guidelines?

- These guidelines are sought to address the pre-operative screening and preparation of surgical patients scheduled for elective and emergency operation, as well as the peri-operative use of positive airway pressure [PAP] therapy e.g. continuous positive airway pressure [CPAP]; bi-level positive airway pressure (Bi-Level PAP) or auto titrated CPAP [Auto CPAP] in patients with diagnosed and undiagnosed OSA.
- We aim to strike a balance between the potential benefits and drawbacks (cost, burden & harms) of any intervention recommended for such patients.
- In order to reflect real life situations and facilitate the assessment of patients. They are divided into 3 categories:
  - Diagnosed OSA, treated
  - Diagnosed OSA, partially treated/untreated
  - Suspected OSA

### 1.7 Are patients with OSA/suspected OSA at increased risk of post-operative complications?

- Two independent meta-analyses have evaluated studies comparing outcomes of patients with and without a diagnosis of OSA. They concluded that OSA is associated with increased risk for post-operative complications - cardiopulmonary adverse events were increased by 2 to 3 fold.<sup>37,38</sup>
- The adverse post-operative outcomes reported include:
  - Pulmonary complications<sup>39,40</sup>
  - Oxygen desaturation<sup>41,42</sup>
  - Difficult mask ventilation and tracheal intubation<sup>43,44</sup>
  - Cardiac complications, e.g. atrial fibrillation, myocardial infarction, pulmonary embolism<sup>45,46</sup>
  - Post op delirium<sup>47</sup>

### 1.8 Should patients at risk of OSA be screened prior to surgery?

- The American Society of Anaesthesiologist [ASA] and Society of Anaesthesia and Sleep Medicine [SASM] recommend that ALL surgical patients should be screened for the risk of OSA before surgery as part of pre-anaesthetic and pre-surgical plan to reduce the risk of peri-operative complications.<sup>48,49</sup>

### 1.9 Which tools can be used to identify surgical patients with suspected OSA in the pre-operative period?

- Pre-operative Screening Tool
  - (a) Questionnaires
  - (b) Oximetry
- (a) Commonly used Pre-operative Validated Questionnaires:
  - STOP-BANG Questionnaire (SBQ)<sup>50,51</sup>
  - Berlin Questionnaire<sup>52,53</sup>
  - P-SAP<sup>54</sup>
  - Sleep Apnoea Clinical Score (SACS)<sup>55</sup>
  - Epworth Sleepiness Scale (ESS)<sup>56</sup>
  - American Society of Anaesthesiologists (ASA) checklist<sup>57</sup>

**STOP-BANG Questionnaire (SBQ)**

- It is the most validated screening tool in surgical patients.
- It is easy to use and is the most sensitive questionnaire at identifying patient with significant sleep apnoea (see [www.stopbang.ca](http://www.stopbang.ca))

The **STOP-BANG questionnaire** consists of a total of 8 dichotomous (yes/no) questions, as follows:

<b>S</b>	Snoring: Do you snore loudly (louder than talking or heard through a closed door)	Yes	No
<b>T</b>	Tired: Do you often feel tired, fatigued or sleepy during daytime?	Yes	No
<b>O</b>	Observed: Has anyone observed you stop breathing during your sleep	Yes	No
<b>P</b>	Blood Pressure: Do you have or have been treated for high blood pressure	Yes	No
<b>B</b>	BMI: BMI >35kg/m <sup>2</sup>	Yes	No
<b>A</b>	Age: Age>50	Yes	No
<b>N</b>	Neck: Neck circumference >40cm (16 inches)	Yes	No
<b>G</b>	Gender: Male	Yes	No

Total Score: 8

(SBQ: 1 point is received for each positive answer)

SBQ scores:

- 0 to 2 = low risk OSA
- 3 to 4 = intermediate risk OSA
- 5 to 8 = high risk OSA

\*\*SBQ scores ≤2 need not be investigated further for OSA.

(b) Oximetry:<sup>58,59</sup>

- Overnight oximetry can be a sensitive and specific tool to detect sleep-disordered breathing in surgical patients.
- It measures the oxygen desaturation index (ODI). ODI is the hourly average number of desaturation episodes, which are defined as at least 4% decrease in saturation from the average saturation in the preceding 120 seconds, and lasting 10 seconds.
- It is not used to diagnose OSA or for prescribing the use of CPAP. It helps us to stratify surgical patients and allocate resources for post-operative monitoring based on OSA-related risk.

### 1.10 When should we refer patients identified high risk for OSA to sleep specialists for further evaluation?

- Patients identified, as high risk for OSA should proceed to surgery provided all necessary precautions against post-operative complications are taken. There is insufficient evidence to support cancelling or delaying surgery to perform sleep testing to confirm the diagnosis of OSA in these patients.
- However, **IF there** is evidence of an associated significant or uncontrolled systemic disease or problems with ventilation or gas exchange, referral to a sleep specialist for further assessment, treatment and optimisation of the comorbid conditions is recommended.<sup>49</sup>
- Additional evaluation for pre-operative cardiopulmonary optimization should also be considered in patients with known OSA who are non-adherent or poorly adherent to PAP therapy and have uncontrolled systemic conditions or additional problems with ventilation or gas exchange<sup>49</sup> such as:
  - Hypoventilation syndromes.
  - Severe pulmonary hypertension.
  - Resting hypoxaemia in the absence of other cardiopulmonary disease.

- The ultimate decision will depend on the relative urgency of the scheduled surgery and should be made after discussing with the surgeon and patient on the risks and benefits of proceeding with the surgery.

### 1.11 Which tests are used to diagnose OSA?

- Polysomnography (PSG):<sup>60</sup>
  - The gold standard for the detection/diagnosing of OSA.
  - It may be the preferred modality if the patient has comorbid medical conditions (such as cardio-pulmonary disease), or if the timing of surgery is not an important factor.
  - CPAP titration in the sleep laboratory allows for precise determination of settings.
  - It is a costly, time consuming and labour intensive technique, which may result in a long waiting list for the patients.
- Home Sleep Apnoea Testing (HSAT):<sup>61</sup>
  - It is convenient and less costly.
  - It has the ability to detect OSA in 82% of adult surgical patients.
  - It is only appropriate for diagnosis of OSA, in patients with moderate to high risk and in the absence of comorbid conditions such as:
    - Patients with significant cardio-respiratory disease
    - Moderate to severe pulmonary disease
    - Heart failure
    - Neurologic conditions
    - Sleep disorder such as insomnia
    - Narcolepsy
    - Movement disorder or central apnoea
  - A negative HSAT study does not definitively rule out OSA. In patient identified as high risk for OSA with a negative HSAT should warrant further Polysomnography (PSG) testing.

### 1.12 What are the recommended pre-operative practices aimed at improving outcomes for surgical patients with known OSA (partially treated/untreated) and suspected OSA?

- Patients and healthcare providers should be aware that being known or suspected to have OSA might be associated with increased peri-operative morbidity.
- Patients with known OSA, partially treated/untreated and suspected OSA with **optimized comorbid** conditions may proceed to surgery provided strategies for mitigation of post-operative complications are implemented.<sup>49</sup>
- Risks and benefits of the (decision) proceeding with the surgery include consultation and discussion with surgeon and patient.
- For patients known to have OSA:
  - Consider obtaining results of sleep study and the recommended PAP setting before surgery.
  - Surgical patients using nasal CPAP must bring their machine with them to the hospital on the day of surgery.

### 1.13 Pre-operative determination of inpatient vs. day surgery

- In deciding if a patient with OSA is suitable for day surgery, the following factors may need to be considered:
  - Severity of OSA, status of co-existing disease, presence of/or risk of a difficult airway, nature of surgery, type of anaesthesia, post-operative opioid requirement, age, adequacy of post discharge observation, capabilities of day surgery facility.<sup>62,63</sup>
  - OSA patients with *optimized comorbid conditions* and able to use CPAP after discharged and post-operative pain can be managed by using **non-opioid** analgesic technique may be considered for day surgery. And their recovery in the PACU uneventful.<sup>64</sup>
  - OSA patients with nonoptimized comorbid medical conditions should be excluded from day surgery.

## 2. INTRA-OPERATIVE MANAGEMENT OF PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

### 2.1 Intra-operative problems that can be encountered include:

- Increased risk of difficult mask ventilation, laryngoscopy and intubation.<sup>43,44</sup>
- Increased sensitivity to sedative and analgesic medications leading to impairment of upper airway dilator muscles activity and ventilatory response to hypoxaemia and hypercapnia.<sup>44,64</sup>
- Increased risk of gastro-oesophageal reflux.<sup>65,66</sup>

### 2.2 What are the choices of anaesthetic techniques?

- Regional Anaesthesia
  - The use of local anaesthesia (LA), peripheral nerve blocks, neuraxial anaesthesia should be considered wherever possible.<sup>44,48</sup>
- Sedation Anaesthesia
  - If it is required, it should always be given to these patients in a supervised setting with the use of continuous capnography. General Anaesthesia with control of the airway may be safer than deep sedation.<sup>48,67</sup>
- General Anaesthesia
  - If general anaesthesia is required, the use of sedative premedication should be avoided.<sup>64,68</sup>
  - Aspiration prophylaxis has been recommended before induction of anaesthesia because of increase risk of aspiration.<sup>65,66</sup>
  - *Anaesthetic agents:*
    - Consider using short-acting drugs including volatile agents like desflurane, propofol for induction and short-acting opioids to allow for a more rapid return of consciousness and baseline respiratory function.

▪ *Airway management*

- OSA is a risk factor for both difficult mask ventilation and tracheal intubation.<sup>43,44</sup>
- Equipment necessary for handling difficult airway should be readily available prior to induction of anaesthesia.<sup>69</sup>
- Adequate preoxygenation is important to increase apnoea tolerance time: Preoxygenation with 100% oxygen for more than 3 minutes with a tightly fitted mask to achieve the end-tidal [O<sub>2</sub>] of at least 90% *OR* with CPAP at 10cm H<sub>2</sub>O.<sup>70,71</sup>
- Optimal intubating conditions should be achieved for laryngoscopy and intubation. Position the patient in a 25°-30 head-up position. This has been shown to improve the glottis view during intubation and reduce atelectasis.<sup>72,73</sup>
- Video laryngoscope or awake fibre optic intubation should be considered if difficult intubation is expected.<sup>69</sup>

▪ *Patient monitoring*

- Minimum monitoring standards should be applicable to all patients as in the “Recommendations for Patient Safety and Minimal Monitoring Standards during Anaesthesia and Recovery (4<sup>th</sup> Edition)” published by the College of Anaesthesiologists Academy of Medicine of Malaysia.<sup>74</sup>
- Additional monitoring may be required depending on the type of surgery and accompanying comorbidities in any given patient.
- Invasive arterial monitoring should be considered for patients with severe OSA or morbid obesity.

▪ *Analgesia*

- Adverse peri-operative outcomes were almost uniformly associated with the use of peri-operative opioids.<sup>44,75-77</sup>
- Consider using a multi-modal approach to analgesia with non-opioid analgesics<sup>78</sup> (LA/regional nerve blocks, paracetamol, NSAIDs, tramadol, ketamine,<sup>79</sup> clonidine, dexmedetomidine<sup>80</sup> or gabapentin).
- If opioids are required use short acting agents when possible.

### ■ *Tracheal Extubation*

#### *Before the trachea is extubated:*

- Ensure full reversal of neuromuscular blockade. It should be verified with a neuromuscular junction-monitoring device (Qualitative or Quantitative).<sup>81</sup>
- Patient should be fully awake, obey simple commands, breathing spontaneously (with an adequate Respiratory Rate and Tidal Volume).
  - Reversal of neuromuscular blockade with sugammadex is preferable over neostigmine when using rocuronium/vecuronium.
  - If possible, positioned the patient in lateral or semi-upright. The semi upright position can decrease upper airway collapsibility.<sup>82</sup>
  - The patient should be inspiring 100% oxygen followed by application of 1 to 2 min of CPAP at 10cm H<sub>2</sub>O pressure while in the operating room.

#### *After trachea extubation:*

- If PAP (e.g. CPAP or BiPAP) equipment is available it should be applied immediately to the patient after extubation (only after patients are awake and alert).

### 3. POST-OPERATIVE MANAGEMENT OF PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

- Patient with OSA have an increased risk of post-operative complication such as respiratory and cardiac events and ICU admission.<sup>83,84</sup>

#### 3.1 What are the risk factors for post-operative respiratory complication?

- **Patient factors**<sup>83,84</sup>
  - Severe OSA (AHI>30)
  - Recurrent respiratory events in post anaesthesia care unit (PACU) such as apnoea, bradypnoea, oxygen desaturation and pain-sedation mismatch.
  - Non-compliance to positive airway pressure (PAP) therapy.
- **Anaesthetic factors**<sup>83,84</sup>
  - Systemic administration of opioids.
  - Use of sedative agents.
- **Surgical factors**<sup>83,84</sup>
  - Surgical site and invasiveness of surgical procedure (Airway surgery and major surgery e.g. thoracic and abdominal surgery).

#### 3.2 Suggested post-operative management for patients with OSA

- **Patient positioning**
  - Patient should be positioned in lateral or semi upright (if permitted) during tracheal extubation or post-operative period to prevent airway obstruction.<sup>82</sup>
- **Positive airway pressure (PAP) therapy**
  - Patients who were previously on PAP therapy should continue to use it post-operatively, unless contraindicated by the surgical procedure.<sup>83</sup>
  - Application of a PAP device should be considered in patients with suspected OSA with recurrent apnoea/hypopnoea or hypoxaemia during the post-operative period.

- **Oxygen Supplementation**

- Supplemental oxygen should be administered continuously to all patients who are at risk of respiratory complication until they are able to maintain their baseline oxygen saturation while breathing room air.<sup>83,84</sup>
- This can be used as an alternative if the patient at risk is not compliant to PAP therapy (CPAP or BiPAP).
- **Caution:** supplementary oxygen may delay the onset of desaturation; it may also delay or mask diagnosis of frequent hypoventilation or apnoea. Patients with obesity hypoventilation syndrome or overlap syndrome (OSA and chronic obstructive lung disease) are at higher risk of hypercapnia with oxygen therapy.

- **Monitoring**<sup>83-87</sup>

- Continuous monitoring of oxygenation and ventilation should be available for all post-operative patients.<sup>87</sup>
- Patients should be monitored until they are no longer at risk of respiratory depression.
- Patients should be observed for the following without stimulation:
  - “PACU 30-Minute Respiratory Event”
    - Apnoea episodes (>10 seconds, 1 episode)
    - SpO<sub>2</sub> <90%
    - Resp rate <8 breaths per min (3 episodes)
    - Pain-sedation mismatch
      - [Pain-sedation mismatch refers to a high pain score on the visual analogue scale with a high level of sedation, and thus concern with further administration of analgesics causing apnoea, bradypnoea or desaturations]
- If above hypo-ventilation events occur, the patient will require continuous post-operative monitoring of oxygenation and ventilation overnight.
- Continuous monitoring may be provided in a critical care unit or in an appropriate step down area.
- Additional monitoring of ventilation with ETCO<sub>2</sub> especially on the first night post-operative is recommended.

- **Post-operative analgesia**

- Multimodal analgesia technique to reduce post-operative opioid requirement.<sup>78</sup>
  - *Opioid-sparing analgesic agents*: nonsteroidal anti-inflammatory agents (NSAIDs), COX-2 inhibitors, paracetamol, dexmedetomidine,<sup>79</sup> ketamine.<sup>80</sup>
  - *Regional analgesia techniques*: local infiltration, peripheral nerve blocks or central-neuraxial analgesia.
  - *Non-pharmacological measures*: Ice compression, transcutaneous electrical nerve stimulation.
- Risks and benefits of adding opioid into local anaesthetic should be considered carefully if central-neuraxial analgesia is planned.
- If patient-controlled analgesia with opioid is used, continuous background infusion should be avoided.
- Minimize concurrent use of sedative agents such as benzodiazepine or barbiturates.

### 3.3 Discharge timing from Post Anaesthesia Care Unit [PACU]

- Patient at risk at post-operative complication from OSA should have extended PACU stay to monitor for any adverse events.
  - This period should be for at least 3 *hours* after standard PACU discharge criteria is met or 3 *hours* after last respiratory event (unless transferred to a critical care unit or in an appropriate step down area in the surgical ward).
  - The 'step down area' in the surgical ward should be near the nursing station where early detection of apnoea and medical intervention can occur. There must be facility to provide continuous monitoring of oxygenation and ventilation to the post-operative patients. There must be a dedicated nurse trained to identify apnoea in patients. And know how to apply PAP therapy.
  - Monitoring oximetry alone can fail to detect significant hypercapnia. Continuous capnography (carbon dioxide monitoring) may assist in management in certain cases.

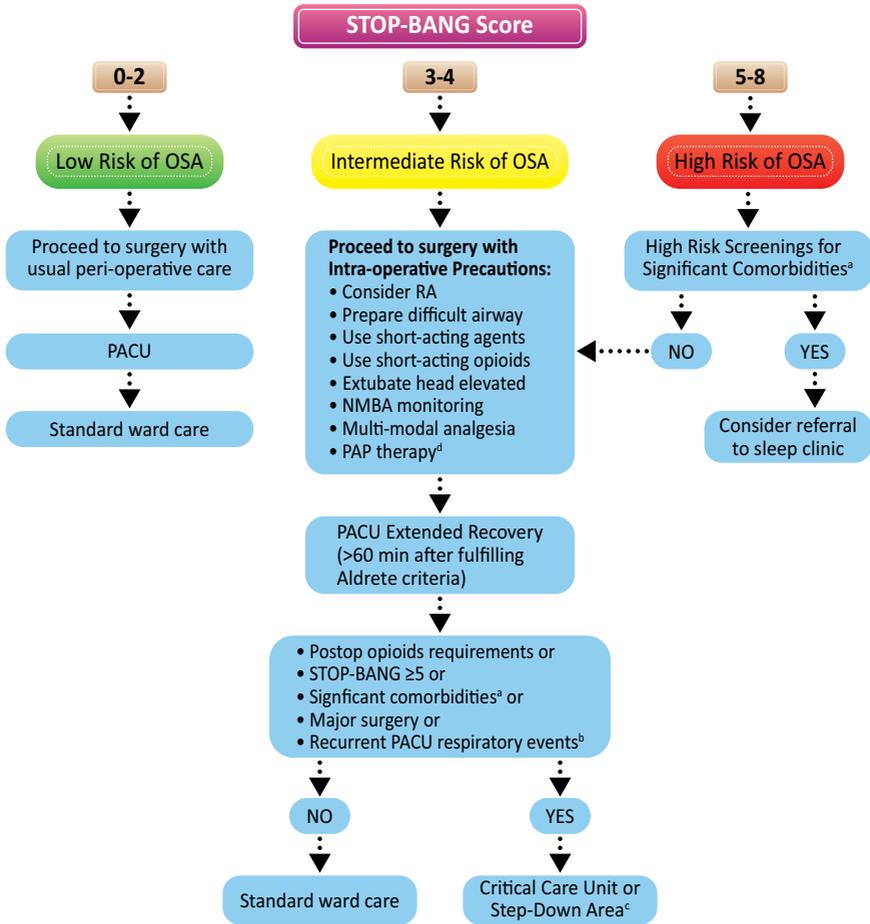
### 3.4 What are the Criteria to discharge patient to a critical care unit or a step-down area in the surgical ward?

- Patients should be transferred to a critical care unit or a step-down area in the surgical ward if there are any pre-existing or post-operative indicators of risk.<sup>85-88</sup>
- Pre-existing risk factors:
  - Severity of OSA
  - Severity of comorbidities
  - Impact of surgery and anaesthesia
  - Post-operative opioid requirement.
- Post-operative risk indicators:
  - Recurrent respiratory event
    - Apnoea episodes (>10 seconds, 1 episode)
    - SpO<sub>2</sub> <90%
    - Resp rate <8 breaths per min (3 episodes)
    - Pain-sedation mismatch
  - New requirement of PAP therapy
  - Respiratory failure
  - Significant risk of myocardial ischaemia or dysrhythmia

### 3.5 Criteria to discharge patient to unmonitored settings<sup>85-88</sup>

- Patients who are no longer at risk of post-operative depression.
- Ability of patients to maintain baseline oxygen saturation levels while breathing room air and maintain adequate breathing in an unstimulated environment (preferably while asleep).
- Pain controlled with non-opioid analgesia or low doses of opioid medication.
- Surgical procedures not associated with post-operative airway oedema (e.g. radical neck dissection).

# SUSPECTED OSA



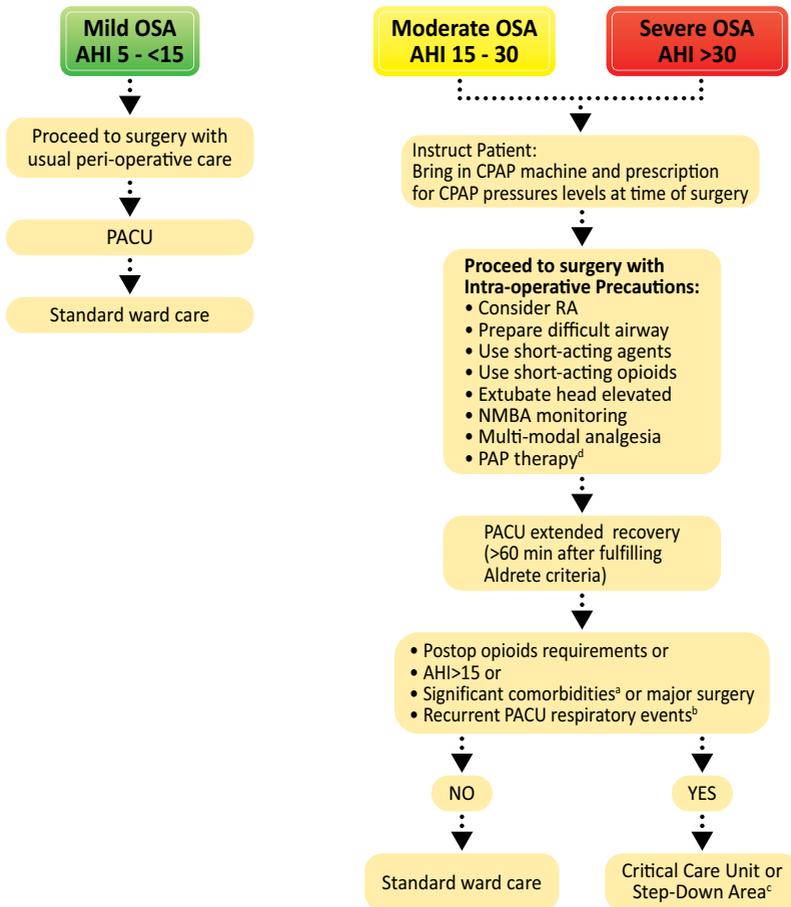
## Annexure 1: Peri-operative Care of Adults with Obstructive Sleep Apnoea

<sup>a</sup>**Significant comorbidities:** heart failure, arrhythmias, uncontrolled hypertension, stroke, metabolic syndrome, obesity.

<sup>b</sup>**Recurrent post anesthesia care unit (PACU):** respiratory event: Apnoea episodes (>10 seconds, 1 episode), SpO<sub>2</sub> <90%, Resp rate <8 breaths per min (3 episodes), Pain-sedation mismatch [Pain-sedation mismatch refers to a high pain score on the visual analogue scale with a high level of sedation, and thus concern with further administration of analgesics causing apnoea, bradypnoea or desaturations].

<sup>c</sup>**Step-down area:** The 'step down area' in the surgical ward should be near the nursing station where early detection of apnoea and medical intervention can occur. There must be facility to provide continuous monitoring of oxygenation and ventilation to the post-operative patients. There must be a dedicated nurse trained to identify apnoea in patients. And know how to apply <sup>d</sup>PAP (positive airway pressure) therapy. **AHI:** Apnoea hypopnoea Index.

# DOCUMENTED OSA



## Annexure 2: Peri-operative Care of Adults with Obstructive Sleep Apnoea

<sup>a</sup>**Significant comorbidities:** heart failure, arrhythmias, uncontrolled hypertension, stroke, metabolic syndrome, obesity.

<sup>b</sup>**Recurrent post anesthesia care unit (PACU):** respiratory event: Apnoea episodes (>10 seconds, 1 episode), SpO<sub>2</sub> <90%, Resp rate <8 breaths per min (3 episodes), Pain-sedation mismatch [Pain-sedation mismatch refers to a high pain score on the visual analogue scale with a high level of sedation, and thus concern with further administration of analgesics causing apnoea, bradypnoea or desaturations].

<sup>c</sup>**Step-down area:** The 'step down area' in the surgical ward should be near the nursing station where early detection of apnoea and medical intervention can occur. There must be facility to provide continuous monitoring of oxygenation and ventilation to the post-operative patients. There must be a dedicated nurse trained to identify apnoea in patients. And know how to apply <sup>d</sup>PAP (positive airway pressure) therapy. **AHI:** Apnoea hypopnoea Index.

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