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Learning Series - #25

Understanding Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is an underrecognized and underdiagnosed medical condition. There are two major consequences of sleep apnea: sleep fragmentation and episodic asphyxia. Sleep disturbances and repeated reductions in blood oxygen levels result in excessive daytime sleepiness, impaired cognitive function, reduced quality of life and serious health problems. Undetected obstructive sleep apnea can lead to hypertension, metabolic disorders, cardiovascular diseases, depression, and even death.

Types of sleep-disordered breathing

Types	Description
Obstructive sleep apnea (OSA)	• more common form • recurrent episodes of complete (apnea) or partial (hypopnea) obstruction of the upper airway (throat muscles relax) leading to reduced or absent breathing for at least 10 seconds • breathing gaps can result in a fall in blood oxygen saturation and/or in sleep disruption
Central sleep apnea (CSA)	• brain does not send proper signals to the muscles that control breathing
Complex sleep apnea syndrome (CSAS)	• also known as mixed sleep apnea • clinical features similar to OSA but patients also exhibit breathing patterns close to patients with CSA
Upper airway resistance syndrome (UARS)	• snoring and repetitive occurrence of respiratory effort-related arousals (RERAs), without oxygen desaturation • common in thin women with certain craniofacial abnormalities
Obesity hypoventilation syndrome (OHS) (formally called Pickwickian syndrome)	• severely overweight people fail to breathe rapidly or deeply enough, resulting in low oxygen and high blood CO2 levels

Risk factors	Complications	Comorbidities
• Excess weight • Sex: more common in male & post-menopausal women • Narrowed airway • Older age • Snoring • Alcohol abuse • Smoking • COPD • Craniofacial abnormalities • Large neck circumference • Acromegaly • Medical conditions: Congestive heart failure, high blood pressure, type 2 diabetes, Parkinson, cancer, prior stroke, PCOS, etc.	• Daytime fatigue and sleepiness • Mood disorders • Hypertension • Cardiovascular problems (CAD; strokes, heart attacks, heart failure) • Type 2 diabetes: increased risk of developing insulin resistance • Metabolic syndrome • Complications with medications and surgery • 15% increased risk of developing cancer • Eye disorders (i.e. glaucoma) • NAFLD (non-alcoholic fatty liver disease): induced through increasing insulin resistance, dyslipidemia, and inflammation • Death	• Cardiovascular diseases (systemic hypertension, coronary artery disease, arrhythmias, ischemic stroke) • Respiratory diseases (COPD, asthma) • Metabolic disorders (diabetes mellitus, dyslipidemia, gout) • Renal disease • Depression, anxiety

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Diagnostic evaluation tools

A) Screening questionnaires:

1. **Epworth Sleepiness Scale (ESS)** is widely used, measures daytime sleepiness. ESS is a self-administered questionnaire with 8 questions. Total score is based on 0 to 24 points (ESS >15 = high chance of severe OSA)
2. **STOP-Bang Questionnaire:** eight yes-or-no questions based on the major risk factors for OSA
   Snoring / Tiredness / Observed Apnea / Pressure / BMI / Age / Neck circumference / Gender (Score ≥ 5 = high risk)

B) Tests:

1) Polysomnography (PSG) - *the gold-standard diagnostic* test

Full-night study	Split-night study
- monitored during typical sleep period which is generally nighttime - for patients who are diagnosed with OSA during a full-night study and who choose positive airway pressure (PAP) therapy - return visit to the sleep laboratory is sometimes required for another study, during which PAP therapy is titrated	- similar to full-night testing, except the diagnostic portion of the study is performed during the first part of the night only - patients who are diagnosed with OSA during the first part of the night and choose PAP therapy can have PAP therapy titrated during the second part of the night - most useful in patients who have an AHI>20 discovered within the first two hours of the study

2) Home Sleep Apnea Testing (HSAT)
- often referred to as ***level 3 ambulatory sleep study***
- monitors only breathing parameters, not actual sleep (i.e. light or deep sleep)
- results can be inconclusive or falsely negative
- less accurate than PSG because of data loss from detached or malfunctioning monitoring equipment
- at-home sleep studies are not as exact as sleep center studies. "Central" apneas may not be recorded accurately on home sleep studies.

3) Overnight *Pulse-Oximetry*
- screening method for patients with high clinical pre-test suspicion
- monitors oxygen saturation levels
- not a substitute for a sleep study – not used to *diagnose / exclude the presence of* OSA

PSG data generate indices as quantitative measures of sleep-related obstructive events per hour of sleep

Indices	Description
Apnea-hypopnea index (AHI)	• number of apnea or hypopnea episodes in one hour • OSA is diagnosed if: - AHI ≥ 15 events per hour - AHI ≥ 5 the presence of symptoms or cardiovascular comorbidities
Respiratory disturbance index (RDI)	• number of apnea, hypopnea and respiratory-effort related arousals (RERAs) per hour of sleep • RDI ≥ AHI
Oxygen desaturation index (ODI)	• normal saturation is around 95% • ODI = 86% ⟶ mild, ODI=80-85% ⟶ moderate, ODI ≤ 79% ⟶ severe

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Treatments

1. **Lifestyle changes:** weight reduction, smoking cessation and positional sleep therapy can help with mild OSA
2. **Continuous positive airway pressure (CPAP):** first line treatment used for moderate to severe OSA. A machine delivers air pressure through a mask while sleeping.
3. **Bilevel positive airway pressure (BPAP):** considered in patients who need high pressure, who hypoventilate during sleep, and who have difficulty exhaling against a fixed pressure. The amount of pressure during inspiration is fixed rather than variable. BPAP can also be set to deliver a breath if a breath was not taken within a certain number of seconds. BPAP can worsen CSA in people with heart failure.
4. **Auto-titrating positive airway pressure (APAP):** used only in patients without significant comorbidities. APAP automatically adjusts pressure as needed to maintain airway patency and can be used in lieu of a formal CPAP titration study. These devices can be maintained in continuous self-adjustment mode or a fixed pressure can be set based on information obtained during titration.
5. **Oral appliances**
   a. Mandibular advancement devices: keep patient's jaw forward to maintain an open airway, and tongue-retaining devices, which splint the tongue in place to keep the airway open.
   b. Oral pressure therapy: a newer device that requires more study; uses a mouthpiece and a vacuum pump to stabilize upper airway tissue. Another option is wearing an oral appliance designed to keep the throat open.
6. **Surgery:** generally, at least three-month trial of other treatment options is suggested before considering. However, for a minority of people with certain jaw structure problems, it can be a good first option.

   Examples of surgeries to correct anatomic obstruction in patients with OSA include:
   1. nasal procedures (e.g., septoplasty)
   2. oral procedures (e.g., uvulopalatopharyngoplasty)
   3. hypopharyngeal procedures (e.g., tongue reduction and stabilization)
   4. laryngeal procedures (e.g., epiglottoplasty)
   5. global airway procedures (e.g., maxillomandibular advancement)

Treatments for central sleep apnea (CSA) might include:

a. Addressing associated medical problems: possible causes of CSA include other disorders (i.e heart failure; neuromuscular disorders) and treating those conditions might help to treat CSA.
b. Adaptive-servo ventilation (ASV): a newer form of positive airway pressure treatments. ASV is a specialized machine that measures breathing patterns and customizes the pressure delivered to stabilize breathing throughout the night. ASV is given if CPAP doesn't effectively treat CSA.
c. Supplemental oxygen: helps with CSA. Various forms of oxygen are available with devices to deliver oxygen to the lungs.
d. Reduction of opioids medication
e. Medications: such as acetazolamide have been used to stimulate breathing.
f. Transvenous phrenic nerve stimulation: a newer therapy that requires more study. It is a system that delivers an electrical pulse to the nerve that controls the diaphragm (phrenic nerve) during sleep, which causes the user to take a breath. This involves a battery-powered pulse generator that's implanted under the skin in the upper chest.

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Compliance

CPAP Compliance

Compliance with CPAP is the key factor required to gain the health benefits associated with treating OSA. CPAP compliance has not only been shown to improve quality of life and sleep indices in patients with OSA, but also lower blood pressure, rates of arrhythmia and stroke, improve left ventricular ejection fraction in patients with heart failure, and improve the rates of fatal and nonfatal cardiovascular events.

CPAP adherence is defined as: ≥ ***4 hours nightly use for 70% of the nights (over at least 30 days)***. Research indicates that at least 6 hours of CPAP usage per night is needed to reduce the health risks of OSA.

The decision to embrace CPAP occurs during the first few days of treatment. Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity. Emerging data suggest that various ***behavioral interventions*** may be effective in improving CPAP adherence.

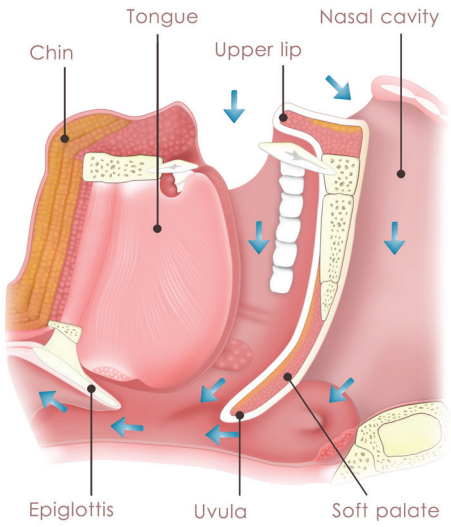
Efficacy should be documented in terms of reversing the symptoms and improvement in sleep apnea based on physiological monitoring.

A periodic (e.g. at least every five years) review of the treatments, including assessments of symptoms and compliance by the primary care physician or sleep specialist is recommended.

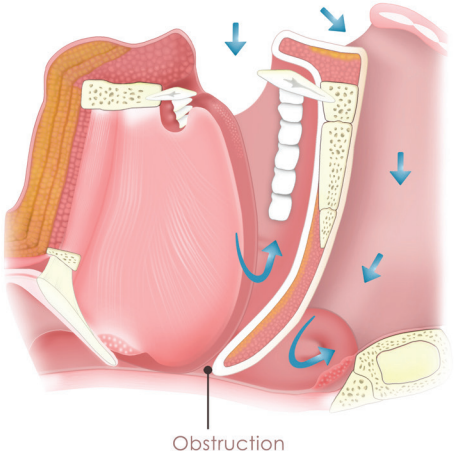
In most ***CSAS cases***, CSA events during initial CPAP titration are transient and they disappear after continued CPAP use. Because CSAS patients have a poor initial experience with CPAP, they may be nonadherent with continued therapy.

Treatment with surgery or oral appliance

For patients treated with surgery or an oral appliance, verification of adequate sleep apnea treatment should be obtained by PSG or level 3 ambulatory sleep study (e.g., AHI ≤ 20 events/h). Reported compliance of at least 4 hours per night for > 70% of nights should be documented (oral appliance).



Open airway during sleep



Sleep apnea present with obstruction

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Understanding Obstructive Sleep Apnea (cont'd)

Obstructive Sleep Apnea & Driving

- In observational studies, patients with OSA had a 2 to 10-fold increased risk of MVAs.
- The diagnosis and management of this condition in both commercial and non-commercial drivers vary significantly across Canada.
- There are significant provincial variations in fitness-to-drive recommendations.
- A driver diagnosed with OSA may be recertified as fit to drive based on assessment of symptoms and demonstrating compliance with treatment. The assessment should be aligned with the provincial driver's license renewal period.
- Commercial drivers who have experienced a crash associated with falling asleep or report they have experienced excessive sleepiness while driving are usually advised to stop driving immediately pending completion of sleep studies and effective treatment.
- For non-commercial drivers, recertification of fitness to drive can be performed by either a sleep physician or the patient's family physician.

Underwriting considerations

1) Determine the severity of the condition. A few "central" apneas may not be significant in otherwise typical OSA cases.
2) Determine the efficacy and compliance with treatment (downloaded CPAP data, physiological monitoring). CPAP compliance can be electronically monitored and are often included in the APS .
3) Any suspicion of OSA in a clinical setting which may require postponement: symptoms of snoring, witnessed apnea & excessive daytime sleepiness.
4) Assess comorbidities: cardiovascular diseases; respiratory diseases; metabolic disorders; depression, anxiety. True central apnea may follow neurologic events such as a stroke, head injury, etc.
5) Presence of risk factors for SA i.e. older males, post-menopausal women, craniofacial abnormalities, smoking, alcohol abuse; sedatives or tranquilizers users etc.
6) Any history of MVA due to sleepiness.