Obstructive sleep apnea

Objectives:

1. To be able to identify patients at risk of obstructive sleep apnea.
2. Recognize common symptoms of obstructive sleep apnea.
3. Implementation of a sleep study in patients suspected to have obstructive sleep apnea and modalities of management.

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Obstructive Sleep Apnea

- Definitions:

- OSA: a sleep-related breathing disorder in which air flow significantly decreases or ceases due to upper airway obstruction (typically in the oropharynx).

Abnormal breathing events:

- **Apnea:** complete or nearly complete (≥ 90%) cessation of inspiratory airflow for ≥ 10 seconds.
- **Hypopnea:** airflow reduction by ≥ 30% of the pre-event baseline for ≥ 10 seconds in combination with either desaturation by ≥ 3% or arousal from sleep,
- **Respiratory effort related arousal (RERA):** arousal from sleep due to increased respiratory effort or reduced airflow for >10 seconds without significant hypopnea or apnea.

- What is Obstructive Sleep Apnea? Criteria A&B or C

Criteria A: The presence of one or more of the following

1. The patient complains of sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms.
2. The patient wakes with breath holding, gasping, or choking.
3. The bed partner or other observer reports habitual snoring, breathing interruptions, or both during the patient's sleep.
4. The patient has been diagnosed with hypertension, a mood disorder, cognitive dysfunction, coronary artery diseases, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus.

Criteria B: Polysomnography (PSG) or OCST demonstrates

1. >5 predominantly obstructive respiratory events (obstructive and mixed apneas, hypopneas, or respiratory effort related arousals (RERAs) per hour of sleep during a PSG or per hour of monitoring (OCST).

For example: Number of times the patient have apnea or hypopnea / Total sleep time → 60 / 10 hrs = 6

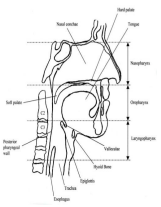
Criteria C: Polysomnography (PSG) or OCST demonstrates

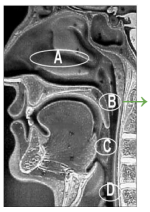
1. >15 events predominantly obstructive respiratory events (apneas, hypopneas, or respiratory effort related arousals (RERAs) per hour of sleep during a PSG or per hour of monitoring (OCST).

To be able to identify patients at risk of obstructive sleep apnea and Recognize common symptoms of obstructive sleep apnea.

- Risk factors:

1. Obesity (strongest risk factor of OSA). Present in >60% of patients referred for a diagnostic sleep evaluation. It's important to measure waist-hip ratio
2. Structural abnormalities (short fat neck "Neck circumference >17/16", small mandible, retrognathia).
3. Upper airway narrowing (large tonsils, large adenoids, long uvula, large tongue).
4. Mallampati Score to Help Predict Obstructive Sleep Apnea. (Class 3 and class 4 Mallampati scores suggest a person has an airway that is narrower than usual)
5. Levels of airway obstruction Excessive salivation during sleep indicates an airway problem because the patient opens his mouth during sleep
6. Family history.
7. Alcohol intake.





→ Level of soft palate

Tongue is inside

- Clinical Features:

- **Nocturnal symptoms:**

- Snoring: 40% of men, 20% of women report habitual snoring, associated with considerable social and marital hazard
- Choking or gasping: Bed partners may recognize this more commonly than the patient.

- **Daytime Sleepiness** :

- Insufficient Sleep - Medical and psychological disorders - Medications

- **Other symptoms**

- Nocturia
- Nocturnal sweating
- Nocturnal chest pain Nocturnal palpitation
- Nocturnal heartburn
- Excessive dreams, nightmares
- Interrupted sleep
- Unrefreshing sleep
- Impotence
- Nightmares and excessive dreams Morning dry mouth and throat
- Morning headache
- Decreased concentration
- Decreased memory
- Low mood
- Easily irritated

- OSA and medical comorbidity:

1. High Blood Pressure.
2. Cardiac problems: Abnormal heart rhythms, heart attack, and heart failure.
3. Memory problem and inability to think.
4. Stroke.
5. Increased insulin resistance (even in non-diabetic).
6. Increased traffic and workplace accidents.

OSA Severity Criteria

	AHI/hr
Normal	< 5
Mild	5 - ≤ 15
Moderate	15 - 30
Sever	> 30

Implementation of a sleep study in patients suspected to have obstructive sleep apnea.

Sleep studies indicated in all patients with excessive daytime sleepiness and at least two of the following:

1. Loud snoring.
2. Witnessed choking, gasping, or apnea during sleep.
3. Diagnosis of hypertension.

Consider in patients with comorbidities, including complications of OSA, and risk factors of OSA.

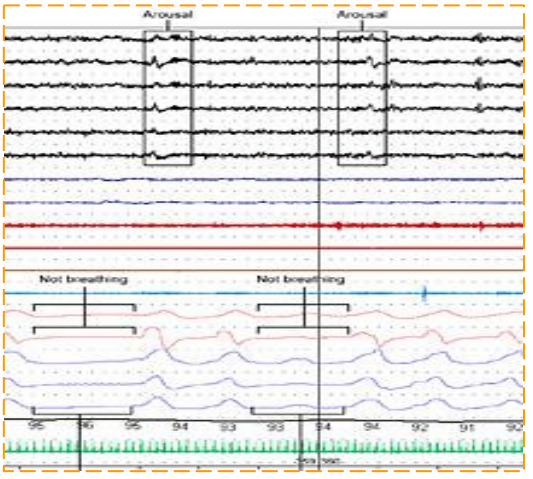
Laboratory PSG indicated in patients with:

1. significant CVD or respiratory diseases.
2. Suspicion of other types of sleep-related disorders.
3. Circumstances precluding a home assessment.
4. Home sleep apnea testing is inconclusive or negative.

Findings: apnea and hypopnea events, oxygen desaturation, respiratory effort-related arousal events (cause sleep fragmentation), and signs of associated comorbidities (hypertension, cardiac arrhythmias).

- Diagnostic criteria of OSA:

- AHI/RDI/REI >5 in patients with symptoms of OSA and/or associated co-morbidities.
- AHI/RDI/REI >15 in patients without symptoms.



- Apnea-hypopnea index (AHI): number of apneas per hour of sleep.
- Respiratory disturbance index (RDI): number of apneas plus hypopneas plus RERAs per hour of sleep.
- Respiratory event index (REI): number of apneas plus hypopneas with desaturation of (more than or equal) 4% per hour of recorded time.

Describe the modalities of management used in OSA.

- General Measures:

These measures should be tried in all patients with OSDB:

- Weight loss.
- Avoidance of alcohol and sedatives.
- Sleep position (try sleeping on the side).
- Driving and operation of heavy machinery.

- Specific Measures:

- Continuous Positive Airway Pressure (**CPAP**). ***Gold standard***
- Intra-oral Appliances: mandibular advancement device.
- Surgical Treatment.
- Hypoglossal Nerve Stimulation.

- Benefits of CPAP:

- Improves quality of life even in mild OSA.
- Improve long term survival
- Improves bed partner sleep.
- Improves daytime sleepiness.
- Decreases motor vehicle accident.
- Improves hypertension.
- Increases ejection fraction in systolic CHF.
- Improves insulin resistance.
- Decrease inflammatory markers (CRP).
- Nasal CPAP is the treatment of choice
- Successful treatment in 95% of patients
- Not as costly as surgery
- Long term compliance 60-70%
- Improve long term survival
- Can re-titrate the pressure if the patient's clinical condition changes

Mild to moderate OSA (<20 apneic episodes on polysomnogram with mild symptoms)	Severe OSA (>20 apneic episodes with arterial oxygen desaturations)
• Weight loss. • Avoid Alcohol and sedatives. • Avoid supine position during sleep.	• CPAP. • Uvulopalatopharyngoplasty. • tracheostomy.

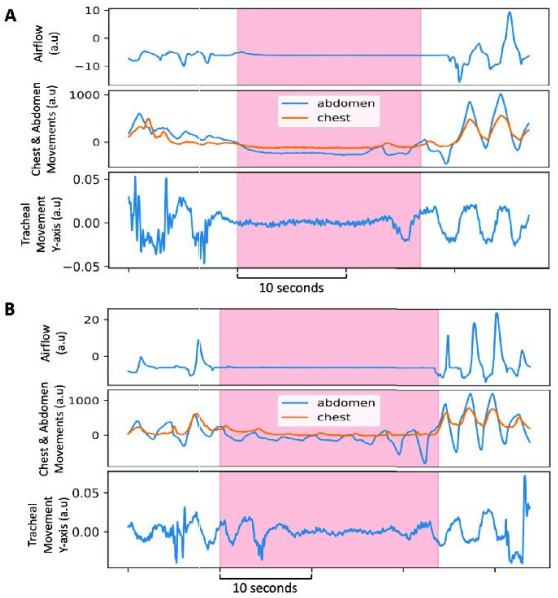
Central Sleep Apnea

- Define Central Sleep Apnea

Is a disorder of decreased breathing rate or depth, particularity during sleep due to a transient reduction or withdrawal of central output to the respiratory muscles (diaphragm and intercostal muscles). Common in patients after stroke and children .

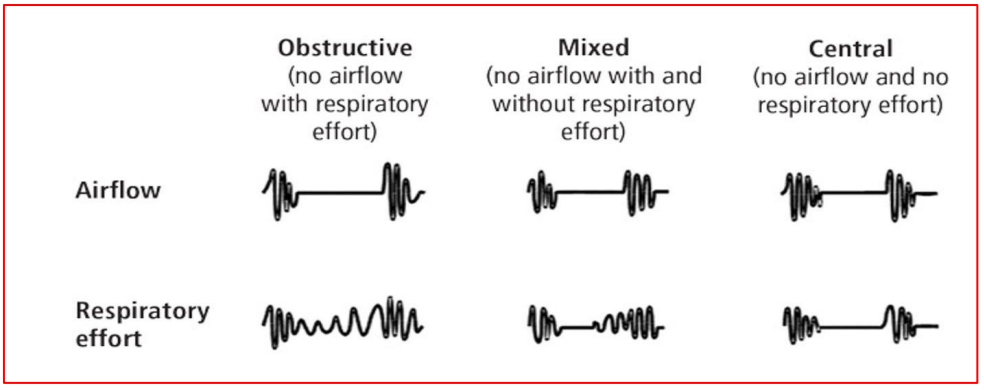
- Describe the difference between Central and Obstructive sleep apneas

	Central Sleep Apnea	Obstructive Sleep Apnea
Pathology	air flow decreases or ceases due to withdrawal of central output to respiratory muscles	air flow decreases or ceases due to upper airway obstruction
Sleep study	A	B



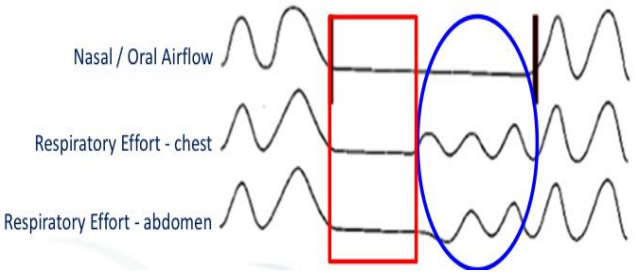
- List the treatment options of Central sleep apnea

- Optimize treatment of underlying condition.
- Ventilation support (CPAP, BPAP).
- Nocturnal oxygen therapy (for CSA related to heart failure).
- Pharmacological treatment (acetazolamide, zolpidem, trizolam).



- Mixed Apnea (Not important at your level)

- Begins as central apnea followed by obstructive apnea
- Seen in patients with OSA
- Often found in Down's Syndrome
- Absent inspiratory effort in the initial portion of
- the event, followed by resumption of inspiratory
- effort in the second portion of the event.



Obesity Hypoventilation Syndrome (OHS)

- **Criteria A-C must be met:**

Criteria A
1. Presence of hypoventilation during wakefulness ($PaCO_2$ > 45 mm Hg) as measured by arterial PCO_2, end-tidal PCO_2, or transcutaneous PCO_2.
Criteria B
1. Presence of obesity (BMI > 30 kg/m 2; > 95th percentile for age and sex for children).
Criteria C
Hypoventilation is not primarily due to: lung diseases medication use neurologic disorder muscle weakness known congenital or idiopathic central alveolar hypoventilation syndrome.

- **Clinical features of OHS**

1- Extreme Obesity
2- Middle-aged
3- Significant sleep-disordered breathing (fatigue, hypersomnolence, snoring, morning headache)
4- Prone to develop severe pulmonary hypertension

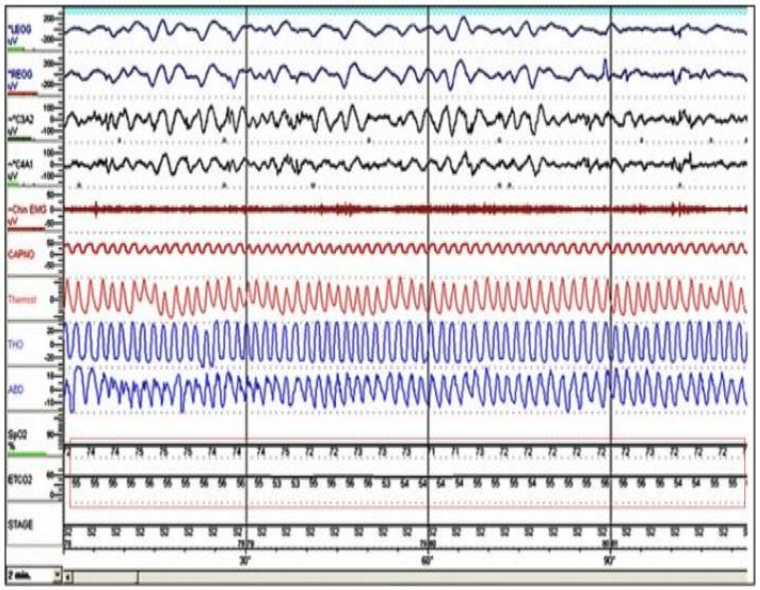
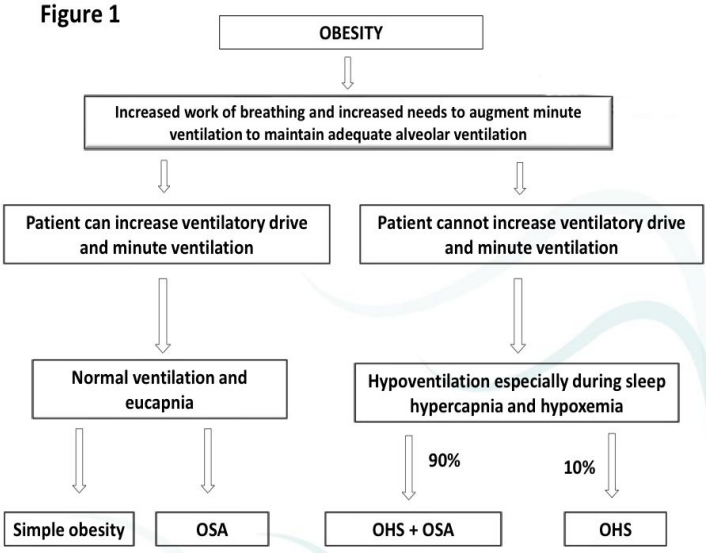


Figure 1



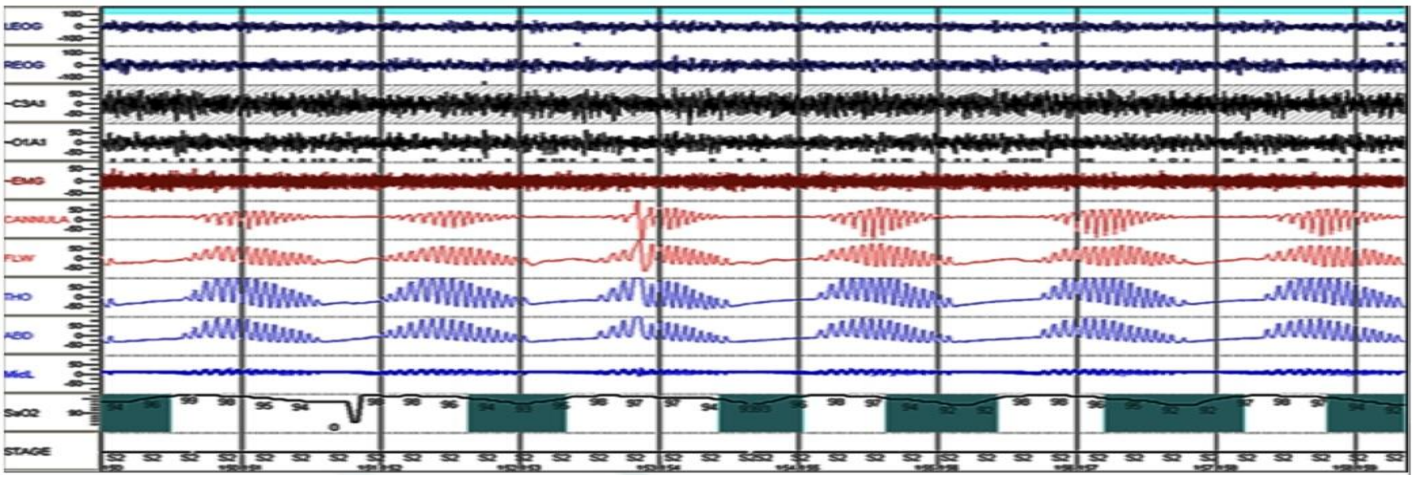
Cheyne Stokes Respiration

- A breathing pattern characterized by regular "**crescendo-decrescendo**" fluctuations in respiratory rate and tidal volume.
- More common among patients with heart failure and low ejection fraction.
- Associated with poor prognosis in patients with heart failure.

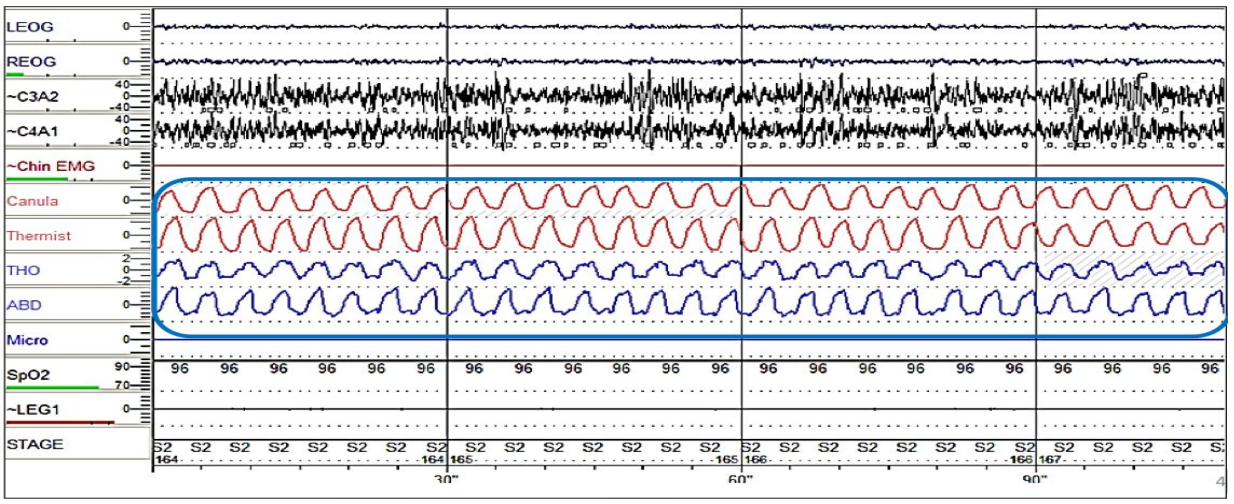
- **(A or B) + C + D satisfy the criteria:**

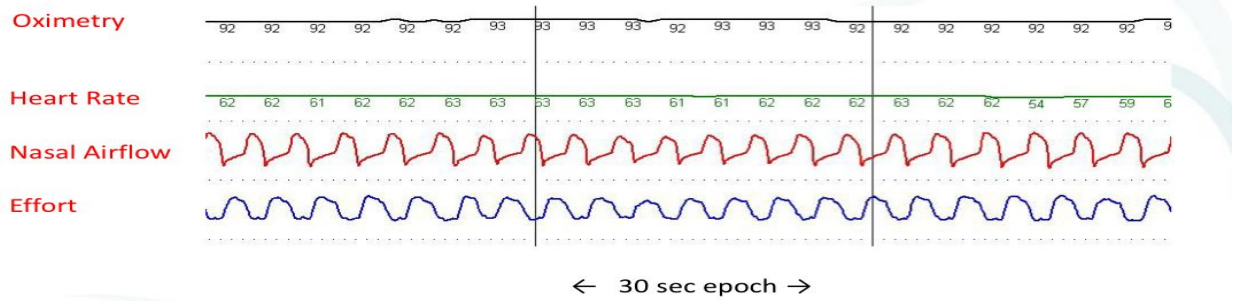
Criteria A
1. The presence of one or more of symptoms
Criteria B
1. The presence of - atrial fibrillation/flutter or - congestive heart failure or - neurological disorder.
Criteria C
1. PSG shows all of the following: - ≥ 5 central apneas and/or central hypopneas per hour of sleep. - The total number of central apneas and/or central hypopneas is > 50% of the total number of apneas and hypopneas. - The pattern of ventilation meets criteria for Cheyne-Stokes breathing (CSB).[1]

1. "crescendo-decrescendo" fluctuations in respiratory rate and tidal volume.



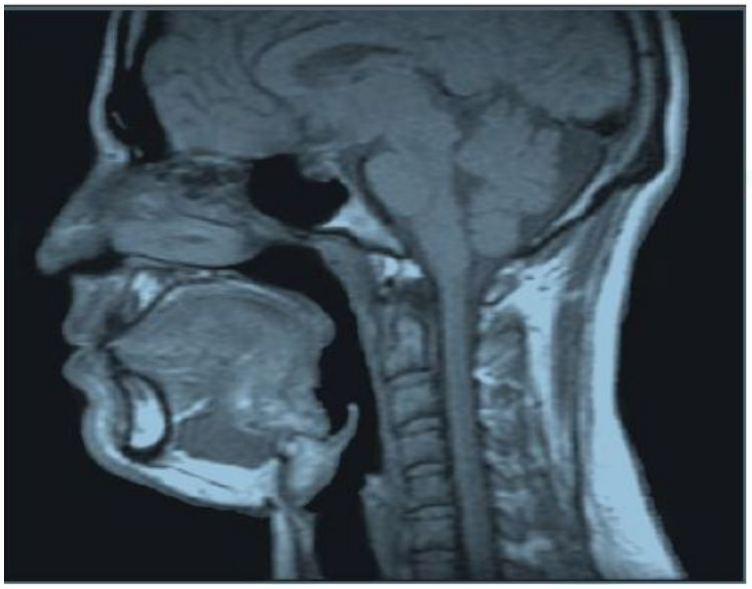
Normal Breathing



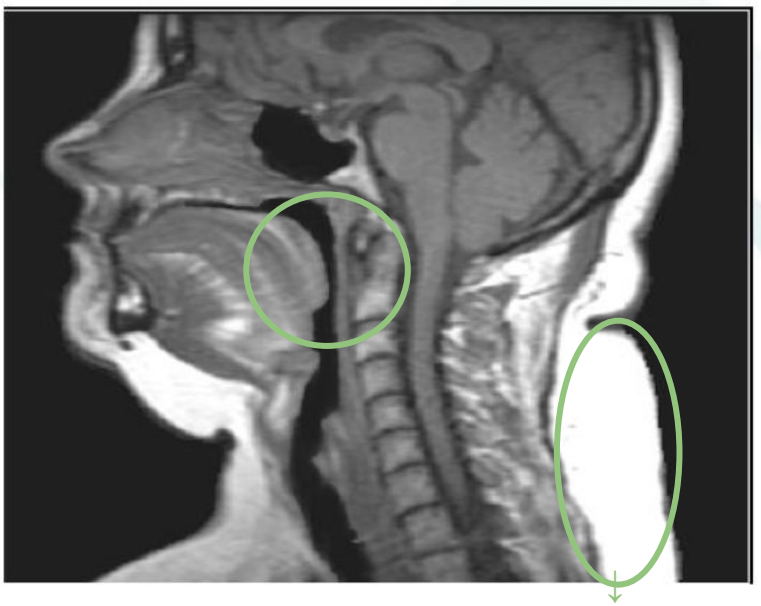


Sagittal Upper Airway MRI Images

Normal



Apneic



This is Fat because he is obese

SLEEP APNEA

Definition and pathophysiology

- **Obstructive:** pharyngeal collapse → apnea (≥10 s) or hypopnea (↓ airflow) ± desaturation; risk factors: obesity (present in 70%), large neck, male sex, ↓ muscle tone, ↑ age, alcohol
- **Central:** ↓ neurologic feedback w/ oscillating drive. Apneas w/o resp effort ± subsequent ↑ resp rate. Associated with CHF & atrial fibrillation; worsened by sedatives.
- Complex: obstructive + central (nb, untreated obstructive → complex)
- Proposed mech: Apnea/arousals → sympathetic nervous system activation, negative intrathoracic pressure → ↑ preload, ↑ afterload. Consequently → HTN, pulm HTN.

Clinical manifestations (*Lancet* 2002;360:237; *Lancet Resp Med* 2013;1:61)

- Snoring, witnessed apneas/gasping, daytime sleepiness
- **Cardiovascular:** HTN (*JAMA* 2012;307:2169); a/w ↑ risk of stroke and death (*NEJM* 2005;353:2034) & possibly CAD & endothelial dysfxn (*AJRCCM* 2001;163:19; *Circ* 2008;117:2270)
- **Neurocognitive:** ↓ cognitive performance, ↓ QoL, ↑ motor vehicle and work accidents (*NEJM* 1999;340:847; *AJRCCM* 2001;164:2031)

Diagnosis and treatment (*JAMA* 2013;310:731 & *Lancet* 2014;383:736)

- **Polysomnography** (sleep study); can do home-testing
- **Obstructive: CPAP** ↓↓ apnea/hypopnea, ↓ BP (*JAMA* 2013;310:2407 & *NEJM* 2014;370:2276), ↓ sleepiness, ↑ performance (*AJRCCM* 2012;186:677), ↑ EF in Pts with CHF (*NEJM* 2003;348: 1233), ↓ metab syndrome (*NEJM* 2011;365:2277), ↓ mortality after stroke (*AJRCCM* 2009;180:36)
- Oral appliances if refusing CPAP; upper-airway stimulator under study (*NEJM* 2014;370:139)
- **Central:** adaptive servoventilation (ASV) *if* w/o CHF (nb, ↑ mortality if CHF; *NEJM* 2015;373:1095)
- Avoid alcohol and sedatives
- Surgery (eg, uvulopalatopharyngoplasty, UPPP) of limited benefit (*Chest* 1997;111:265)

Lecture Quiz

1:A / 2:A / 3:A / 4:C

- **Case:**

A 50 year old man with a past medical history significant for type 2 diabetes mellitus presents to his primary care physician complaining of excessive daytime sleepiness.He claims that he gets 8 hours of sleep every night yet wakes up every morning with a headache and dry mouth. He finds himself to be lethargic and often falling asleep at work.His wife complains that he snores all night long. On physical examination he is afebrile, with a heart rate of 90/min, RR 12/min, and BP of 150/90 mmhg. He is 178 cm tall and weighs 115 kg. Head and neck examination is notable for a large, low-hanging soft palate, and a neck circumference of 43 cm. Heart, lung, and neurologic examination are unremarkable. Hematology and electrolyte panels are normal

Q1: What is the most likely diagnosis?

A. Obstructive sleep apnea
B. COPD
C. Depression
D. Narcolepsy

Q2: How is this condition diagnosed?

A. Sleep study
B. Spirometry
C. CT scan
D. EEG

Q3: What are the treatment options?

A. Lifestyle modification, CPAP, Surgery.
B. Bronchodilators
C. SSRIs
D. Steroids

Q from the doctor slide: A breathing pattern characterized by regular "crescendo-decrescendo" fluctuations in respiratory rate and tidal volume?

A. Obstructive Apnea
B. Hypopnea
C. Cheyne Stokes Respiration
D. OHS (Obesity Hypoventilation Syndrome)