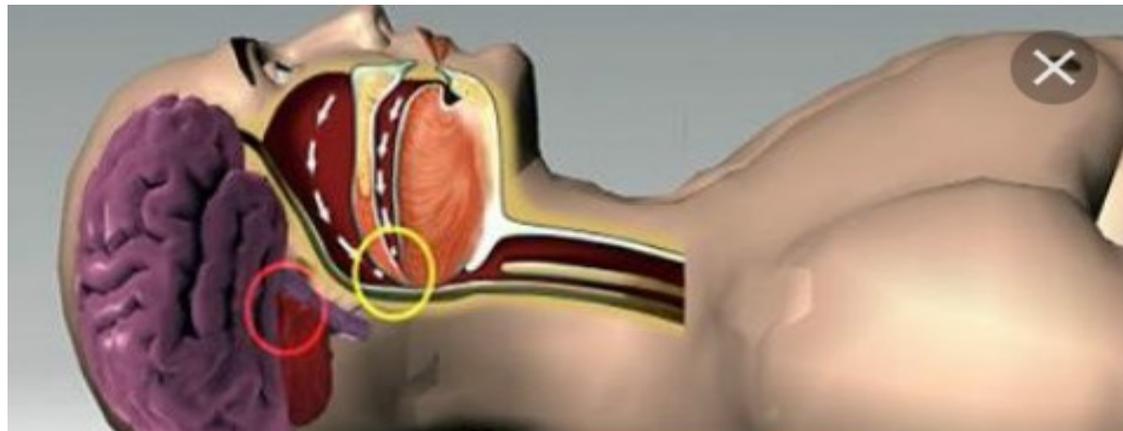


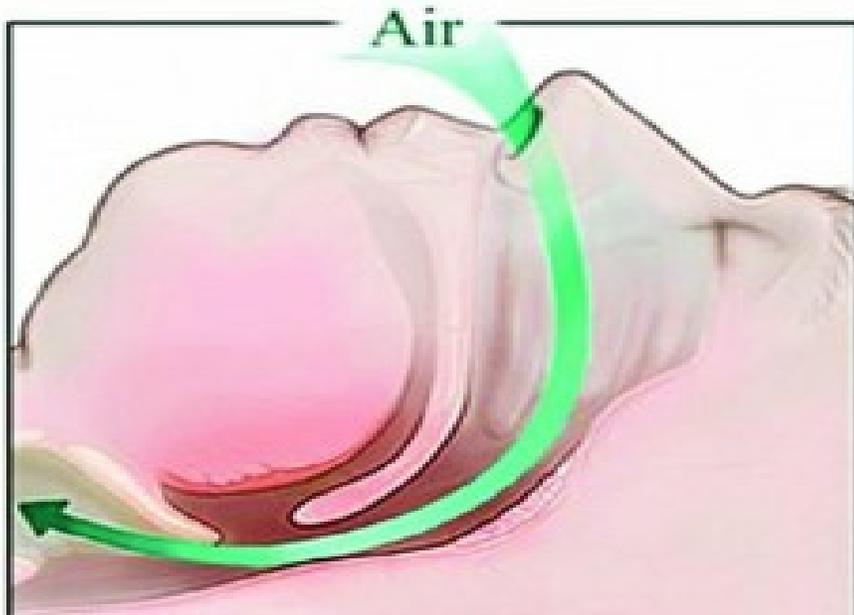
OSA-OHS

DR :ABD ALRAHMAN ALDAKAK

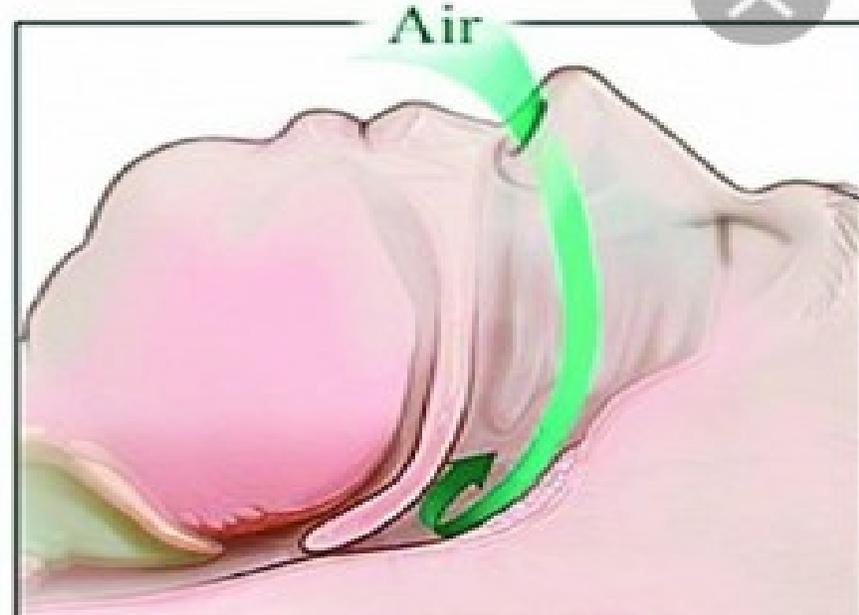
- ▶ **Obstructive sleep apnea (OSA) is**
- ▶ **a disorder that is characterized by obstructive apneas and hypopneas due to repetitive collapse of the upper airway during sleep**



تنفس طبيعي اثناء النوم



مرضى مصاب يتوقف التنفس اثناء النوم

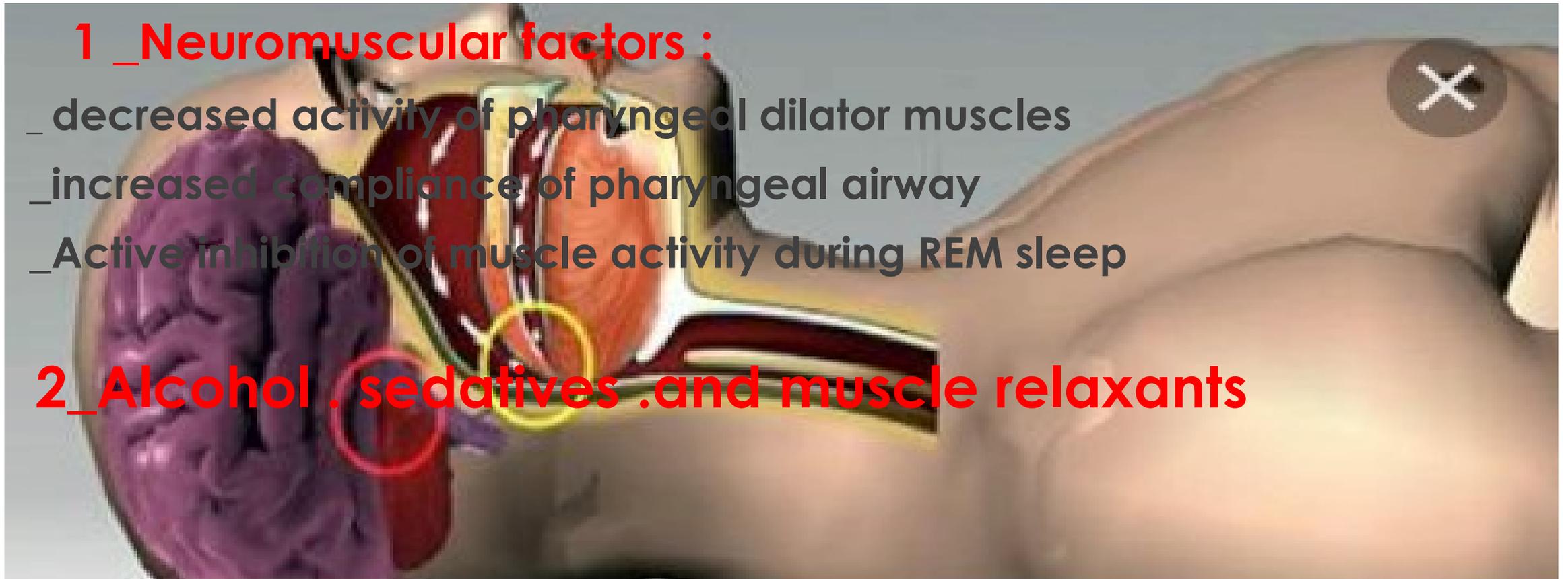


Etiology of OSA:

1 Neuromuscular factors :

- _ decreased activity of pharyngeal dilator muscles
- _ increased compliance of pharyngeal airway
- _ Active inhibition of muscle activity during REM sleep

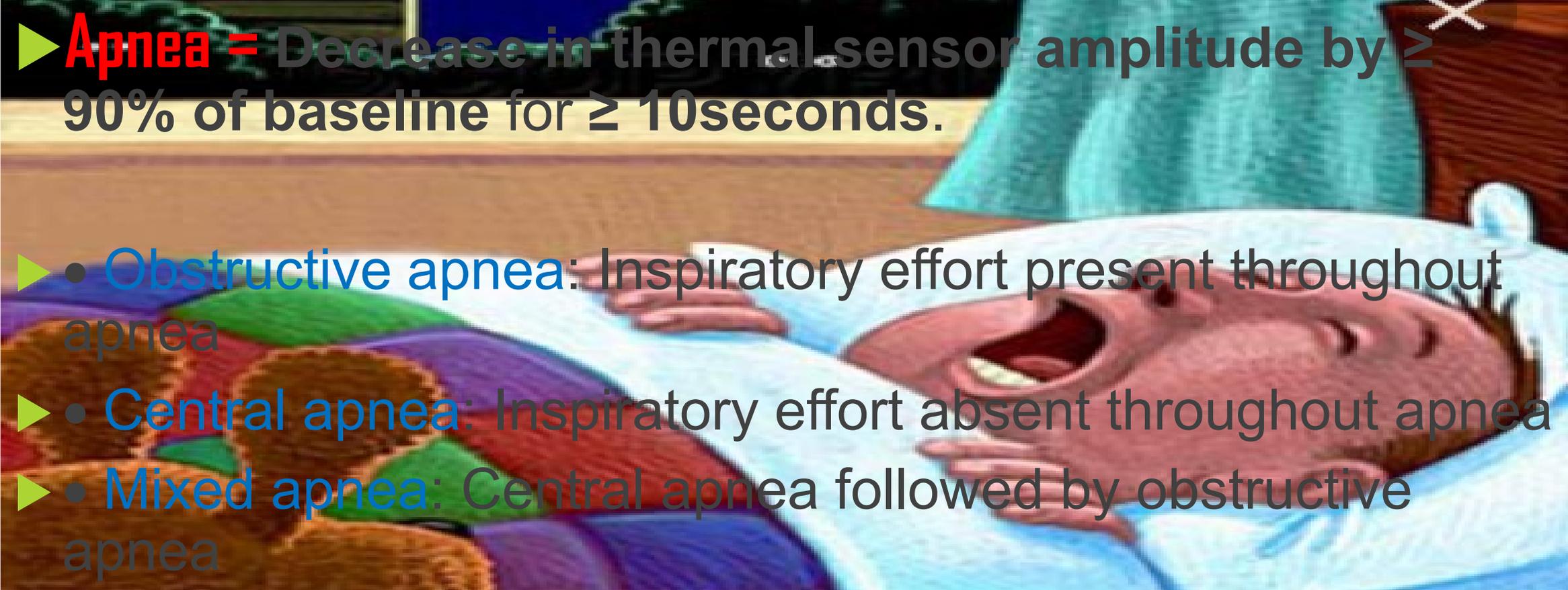
2 Alcohol . sedatives .and muscle relaxants



- ▶ Obstructive sleep apnea (OSA) is a common chronic disorder that often requires lifelong care.



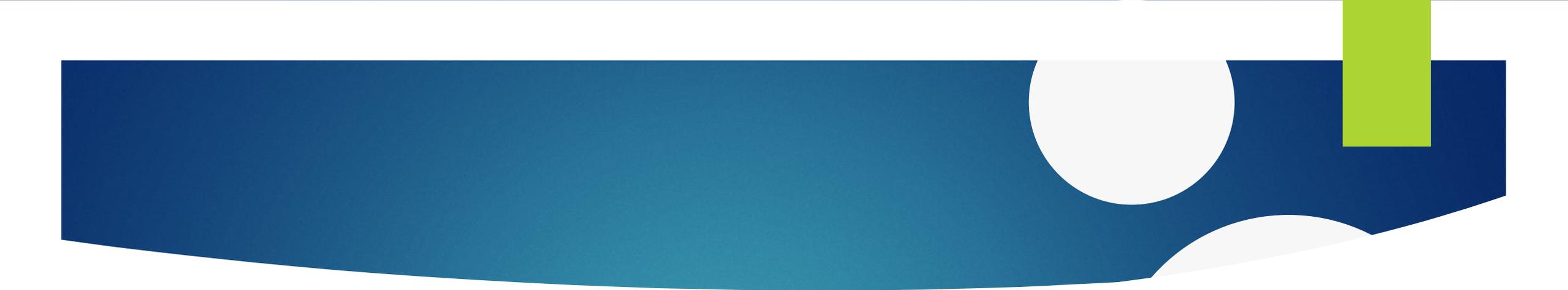
Terminology :

- 
- An illustration of a man lying in bed, snoring. His mouth is wide open, and a large white 'X' is drawn over it to indicate the sound of snoring. He is wearing a blue shirt and is covered with a colorful blanket. The background shows a window with a view of a night landscape.
- ▶ **Apnea** = Decrease in thermal sensor amplitude by $\geq 90\%$ of baseline for ≥ 10 seconds.
 - ▶ • **Obstructive apnea**: Inspiratory effort present throughout apnea
 - ▶ • **Central apnea**: Inspiratory effort absent throughout apnea
 - ▶ • **Mixed apnea**: Central apnea followed by obstructive apnea

Terminology :

- ▶ **Hypopnea**=Decrease in nasal pressure by $\geq 30\%$ for ≥ 10 seconds with a $\geq 4\%$ drop in oxygen saturation





▶ **AHI & RDI :**

- ▶ **apnea-hypopnea index (AHI)**, the number of apneas and hypopneas per hour of sleep)
- ▶ **The obstructive RDI is the number** of obstructive apneas, obstructive hypopneas, and respiratory effort related arousals (**RERAs**) per hour of sleep;
- ▶ **it is usually higher than the AHI**

The Cardinal features in adults include:

Snoring

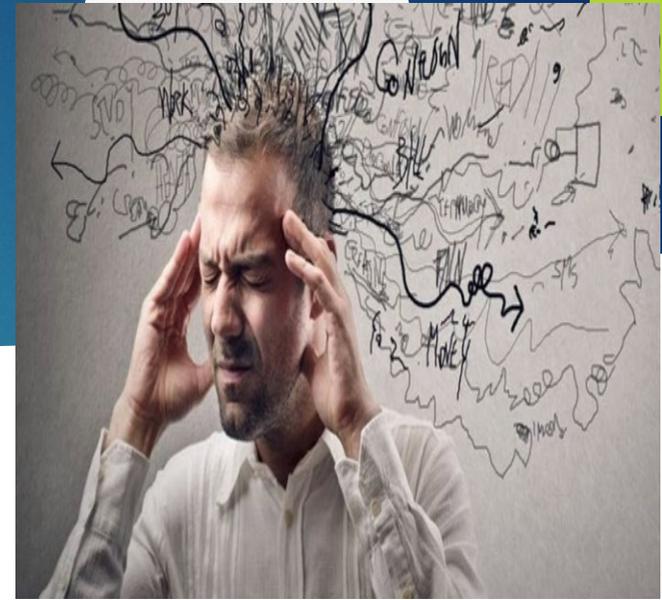
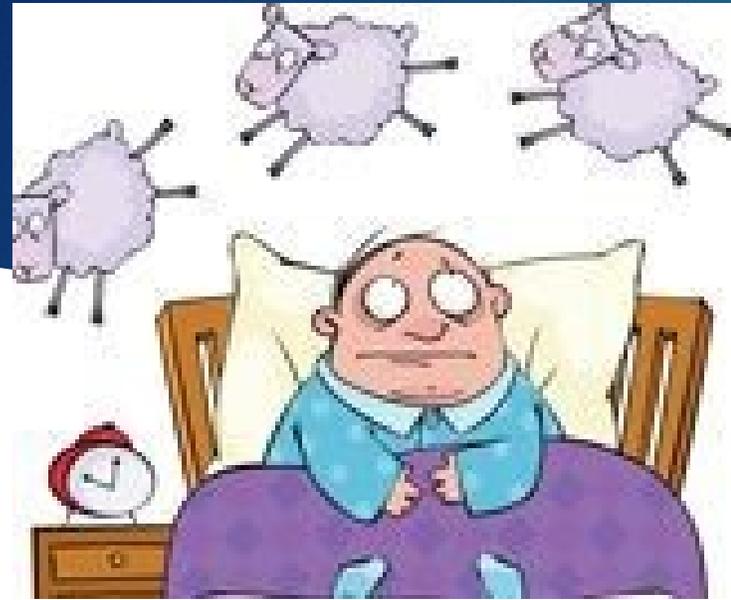
Sleepiness

Sleep apnea episodes



The Cardinal features in adults include:

- ▶ **Signs of disturbed sleep**, such as snoring, restlessness, or resuscitative snorts
- ▶ **Daytime symptoms** attributable to disrupted sleep, such as sleepiness, fatigue, or poor concentration
- ▶ **Obstructive apneas**, hypopneas, or respiratory effort related arousals



SIGNS AND SYMPTOMS

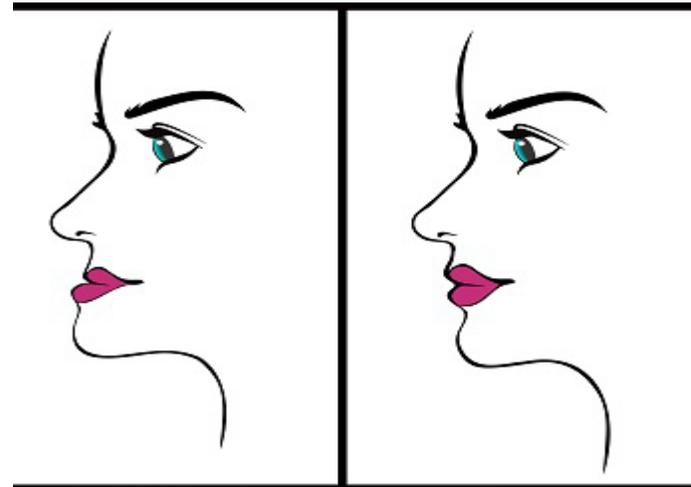
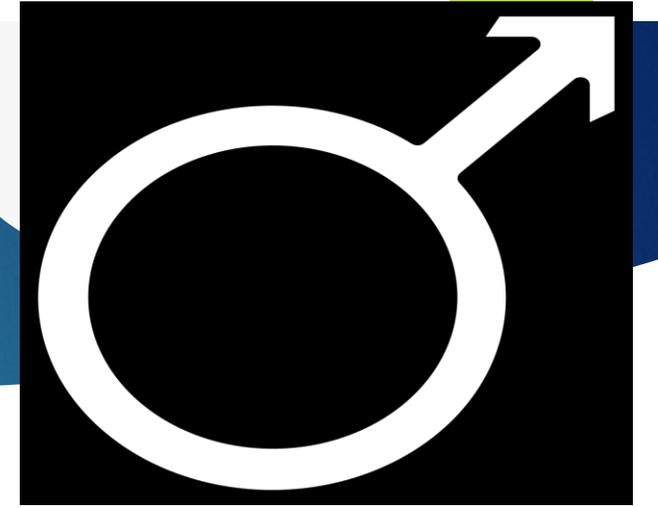
- ▶ • Unexplained daytime sleepiness
 - ▶ • Witnessed nocturnal apneas
 - ▶ • Frequent nocturnal awakenings
 - ▶ • Insomnia
 - ▶ • Morning headaches
 - ▶ • Nocturia
 - ▶ • Difficult concentrating and mood disorders (Depression)
- 
- A cartoon illustration of a woman with blonde hair, wearing a blue nightgown, sitting up in bed. She has a tired or stressed expression. To her right is a wooden bedside table with an orange alarm clock. The clock face shows the time as approximately 10:10. The background is a simple white wall.

Other associated symptoms and historical features include:

- ▶ **Awakening with a sensation of choking, gasping, or smothering**
- ▶ ●Awakening with a dry mouth or sore throat
- ▶ ●Memory impairment
- ▶ ●Awakening with angina pectoris
- ▶ ●**History of hypertension, cardiovascular disease, cerebrovascular disease, or renal disease**
- ▶ ●History of type 2 diabetes mellitus
- ▶ ●Symptoms of fibromyalgia
- ▶ ●Gastroesophageal reflux disease
- ▶ ●History of polycystic ovary syndrome



RISK FACTORS



RISK FACTORS

- ▶ **advancing age**
- ▶ **male gender**
- ▶ **obesity**
- ▶ **and craniofacial morphology or upper airway soft tissue abnormalities**

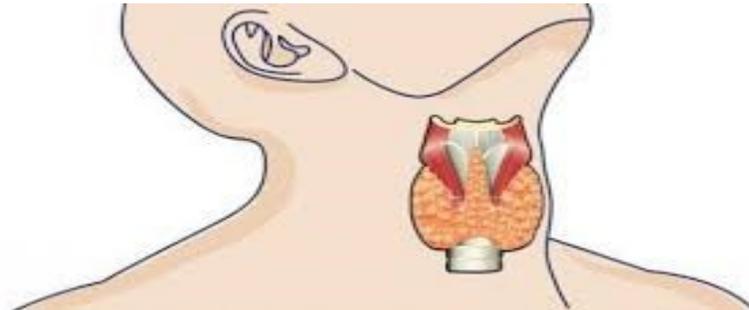
Additional factors

- ▶ **smoking,**
- ▶ **nasal congestion,**
- ▶ **menopause**
- ▶ **and family history.**



Additional factors

- ▶ **Rates of OSA are also increased in association with certain medical conditions, such as**
- ▶ pregnancy,
- ▶ end-stage renal disease,
- ▶ congestive heart failure,
- ▶ chronic lung disease,
- ▶ post-traumatic stress disorder,
- ▶ and stroke
- ▶ . Acromegaly
- ▶ Hypothyroidism
- ▶ Polycystic ovary syndrome
- ▶ Post-traumatic stress disorder

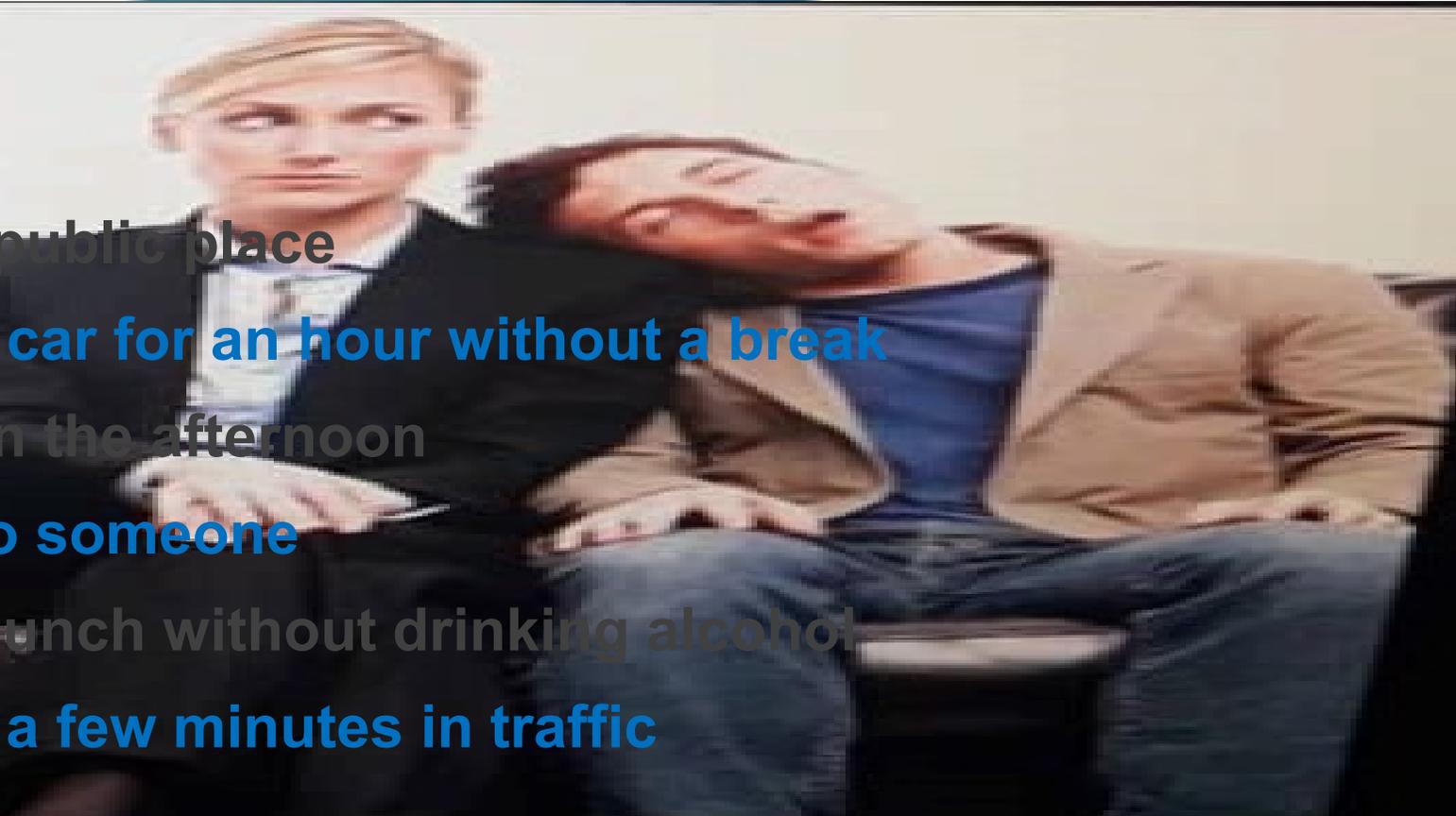


Epworth Sleepiness Scale

- ▶ Eight-item questionnaire that evaluates the chances of dozing off to sleep on a scale of - 0 (never) to 3 (high chance) under the following conditions:



Epworth Sleepiness Scale

- 1) **Sitting and reading**
 - 2) • **Watching television**
 - 3) • **Sitting inactive in a public place**
 - 4) • **As a passenger in a car for an hour without a break**
 - 5) • **Lying down to rest in the afternoon**
 - 6) • **Sitting and talking to someone**
 - 7) • **Sitting quietly after lunch without drinking alcohol**
 - 8) • **Stopped in a car for a few minutes in traffic**
- 

Epworth Sleepiness Scale

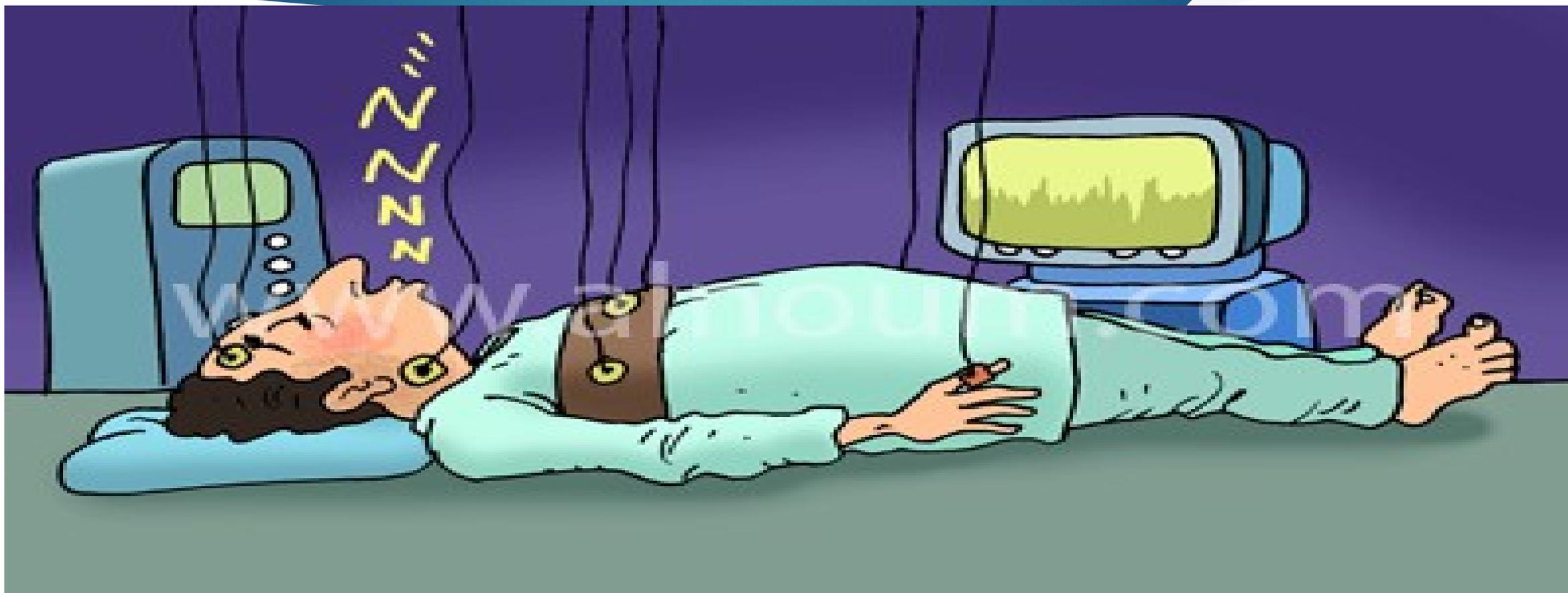
- ▶ An aggregate score of ≥ 10 indicates excessive daytime sleepiness.



Evaluation :

- ▶ **Thyroid function tests**
- ▶ **Arterial blood gas**
- ▶ **CBC**
- ▶ **ECG**
- ▶ **Echocardiography**
- ▶ **Radiological studies**
- ▶ **polysomnography**

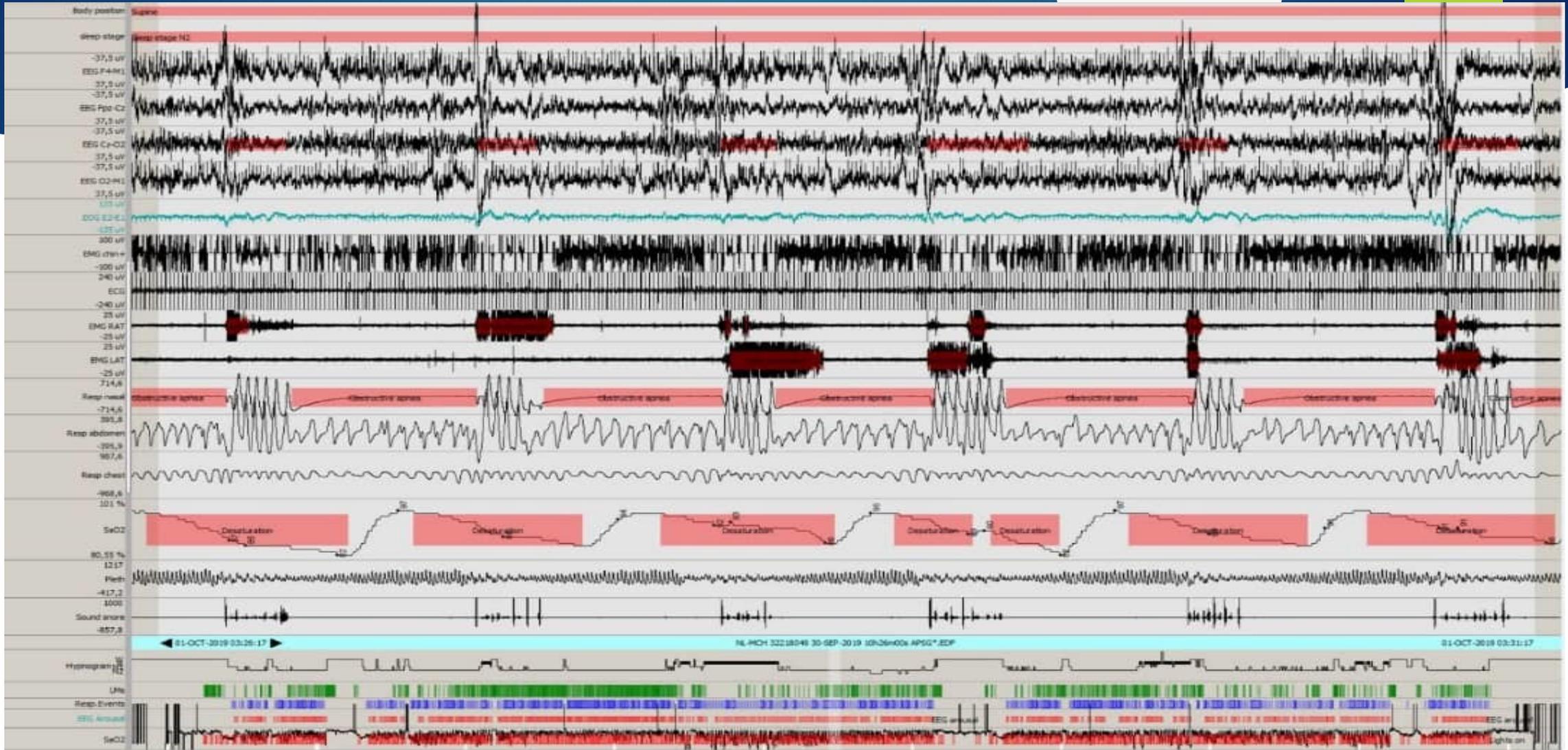
DIAGNOSIS:



DIAGNOSIS:

- ▶ In-laboratory polysomnography is the first-line diagnostic study
- ▶ home sleep apnea testing (HSAT)





a diagnosis of OSA is defined by either of the following

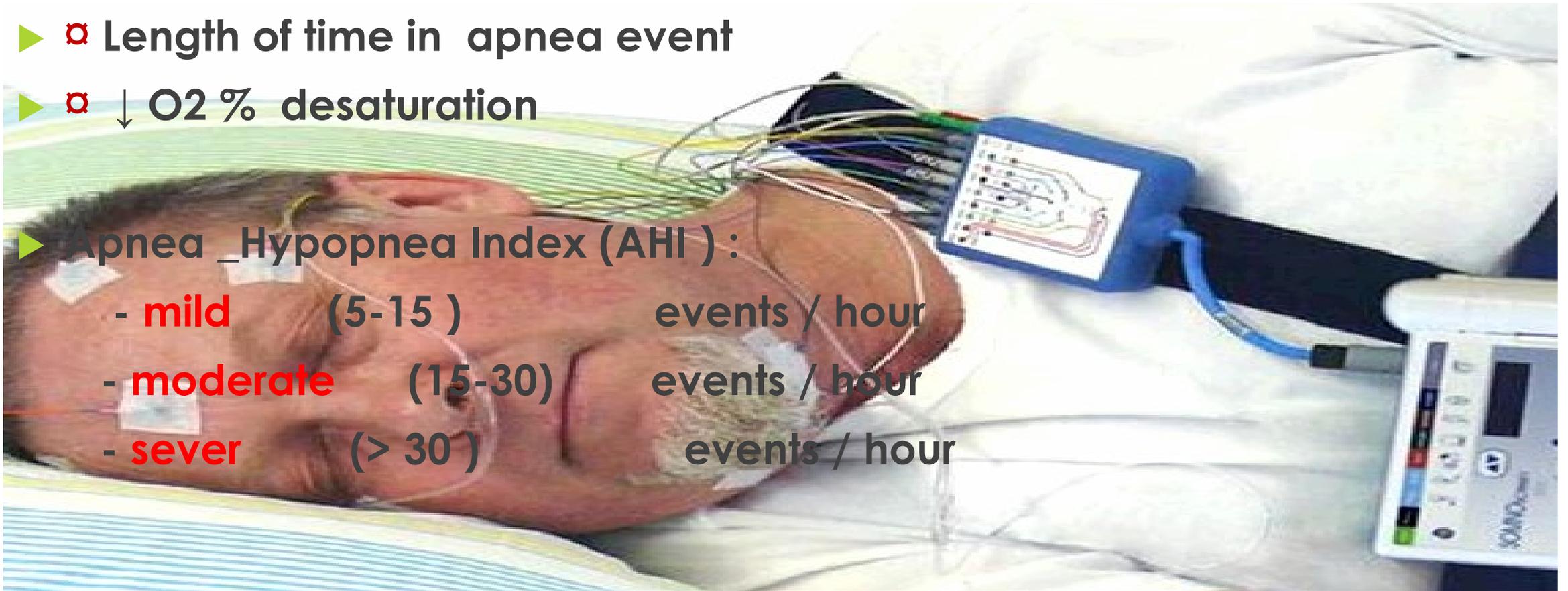
- ▶ ● There are five or more predominantly obstructive respiratory events (obstructive and mixed apneas, hypopneas, or respiratory effort related arousals) per hour of sleep (for polysomnography) or recording time (for HSAT) in a patient with one or more of the following:
 - ▶ ● Sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms
 - ▶ ● Waking up with breath holding, gasping, or choking
 - ▶ ● Habitual snoring, breathing interruptions, or both noted by a bed partner or other observer
 - ▶ ● Hypertension, mood disorder, cognitive dysfunction, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus

Severity of OSA :

- ▶ \square Length of time in apnea event
- ▶ \square \downarrow O₂ % desaturation

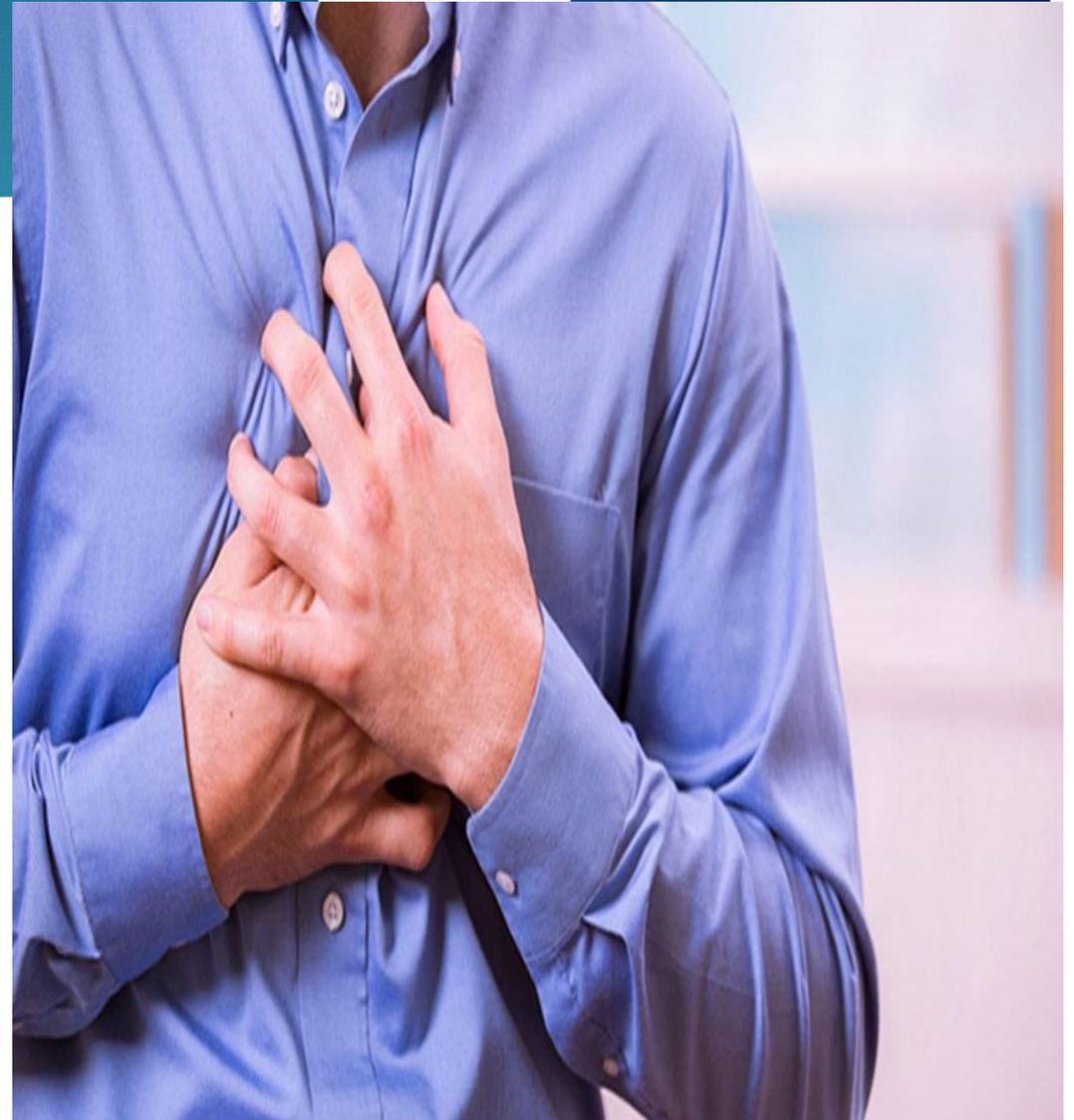
▶ Apnea _Hypopnea Index (AHI) :

- **mild** (5-15) events / hour
- **moderate** (15-30) events / hour
- **sever** (> 30) events / hour



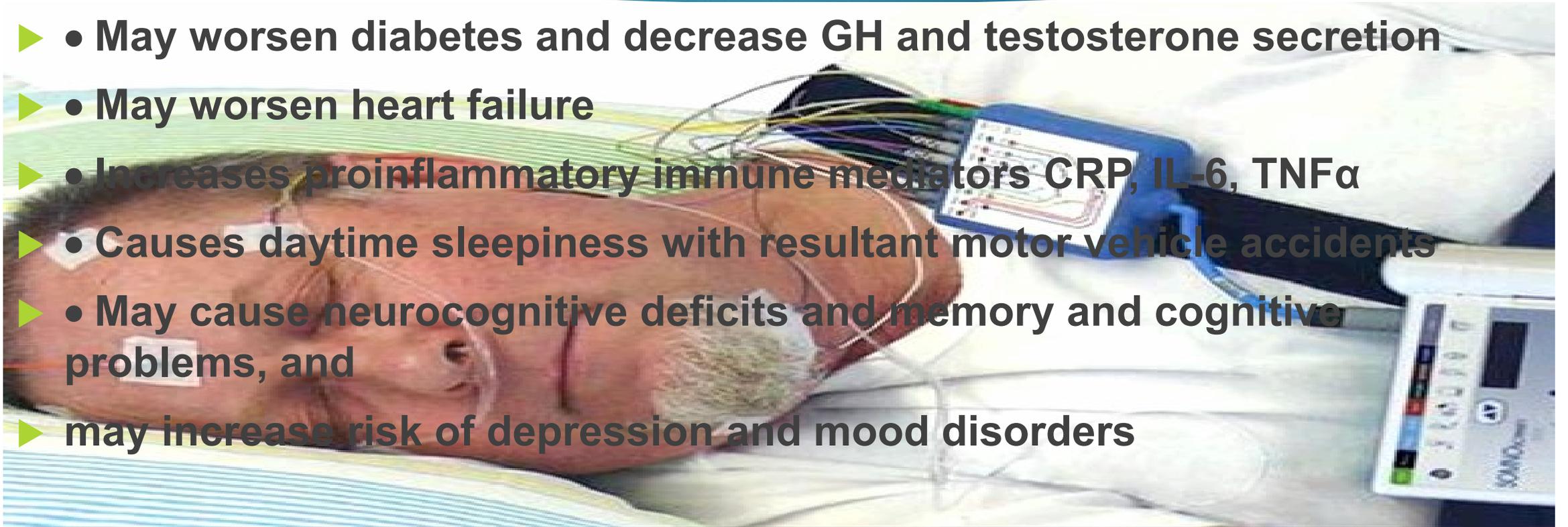
CONSEQUENCES

- ▶ ● **Increases risk of:**
- ▶ ○ **Myocardial infarctions**
- ▶ ○ **Cerebrovascular accidents**
- ▶ ○ **Pulmonary hypertension**
- ▶ ○ **Hypertension**
- ▶ ○ **Sudden death**



CONSEQUENCES

- ▶ • May worsen diabetes and decrease GH and testosterone secretion
- ▶ • May worsen heart failure
- ▶ • Increases proinflammatory immune mediators CRP, IL-6, TNF α
- ▶ • Causes daytime sleepiness with resultant motor vehicle accidents
- ▶ • May cause neurocognitive deficits and memory and cognitive problems, and
- ▶ may increase risk of depression and mood disorders



Central Sleep Apnea (CSA)

- ▶ **Loss of ventilatory effort during sleep resulting in repetitive cessation of airflow.**

Central Sleep Apnea (CSA)

▶ **NONHYPERCAPNIC CSA:**

- ▶ Normal or low partial pressure of carbon dioxide (PaCO_2) and increased ventilatory response to hypercapnia
- ▶ **Cheyne–Stokes respirations (CSRs)** are characterized by crescendo–decrescendo
periodic breathing

Cheyne–Stokes respirations (CSRs)

- ▶ ○ Increased chemoreceptor sensitivity to carbon dioxide (CO₂)
- ▶ ○ Increased ventilatory drive
- ▶ ○ Increased circulatory time secondary to decreased cardiac output from heart failure

- ▶ ○ Decreased oxygen reserve

HYPERCAPNIC CSA:

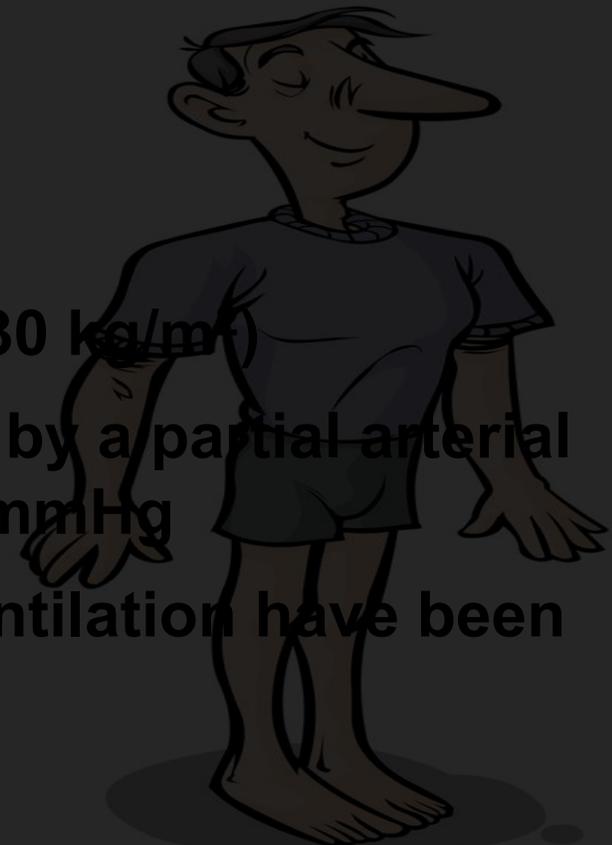
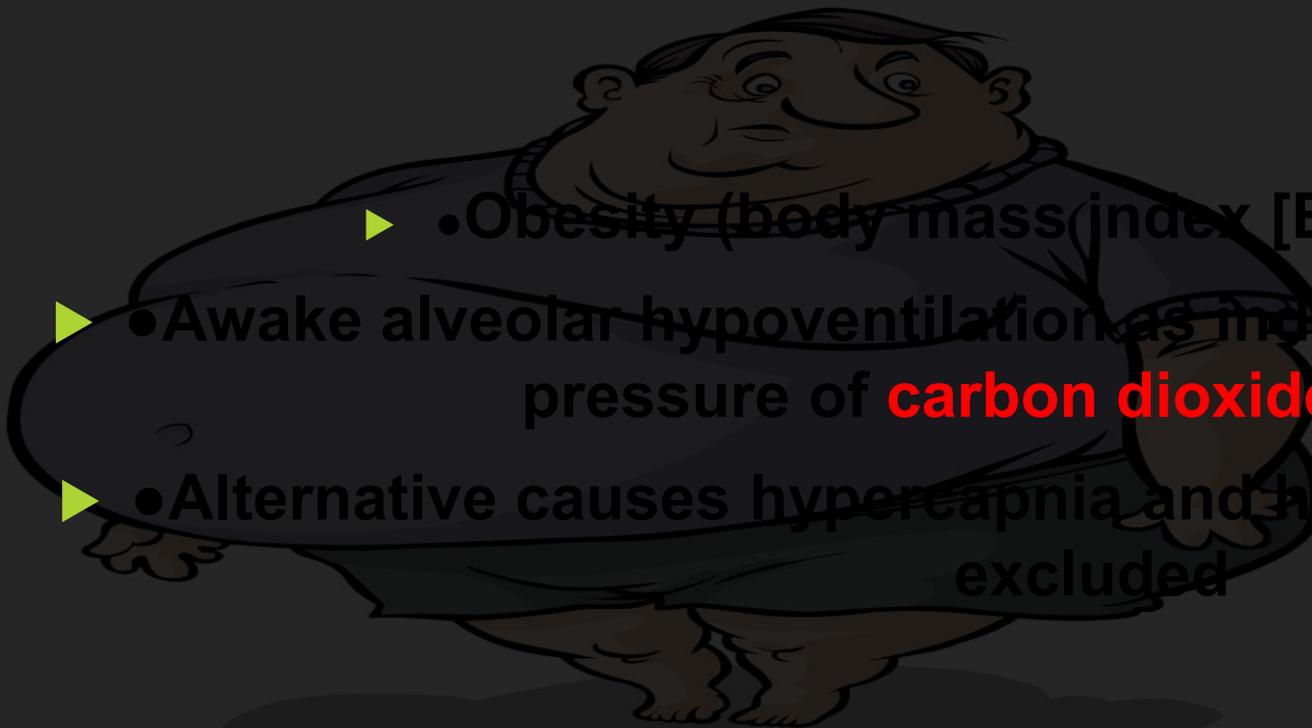
- ▶ **Elevated PaCO₂** during sleep caused by decreased ventilatory response to hypercapnia.
- ▶ **Opioid-induced apnea** is induced most commonly by long-acting opioids, mainly methadone.

▶ Obesity Hypoventilation Syndrome (OHS)

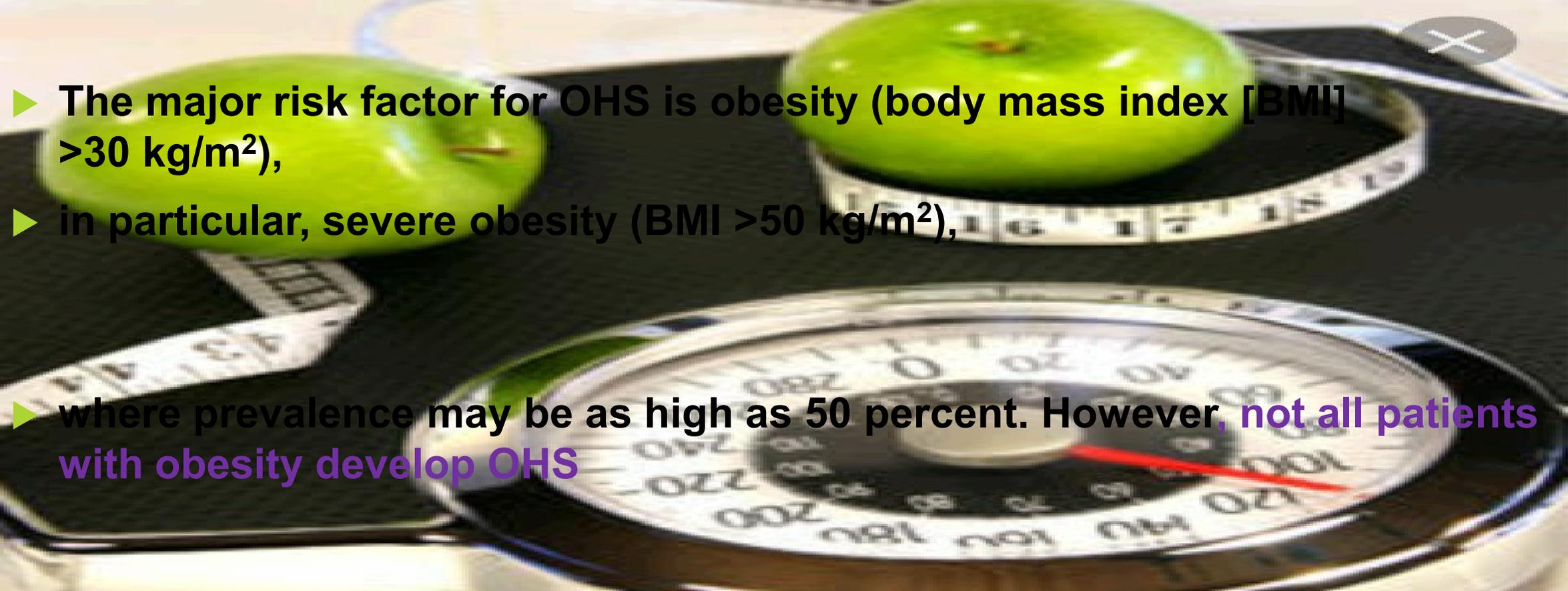


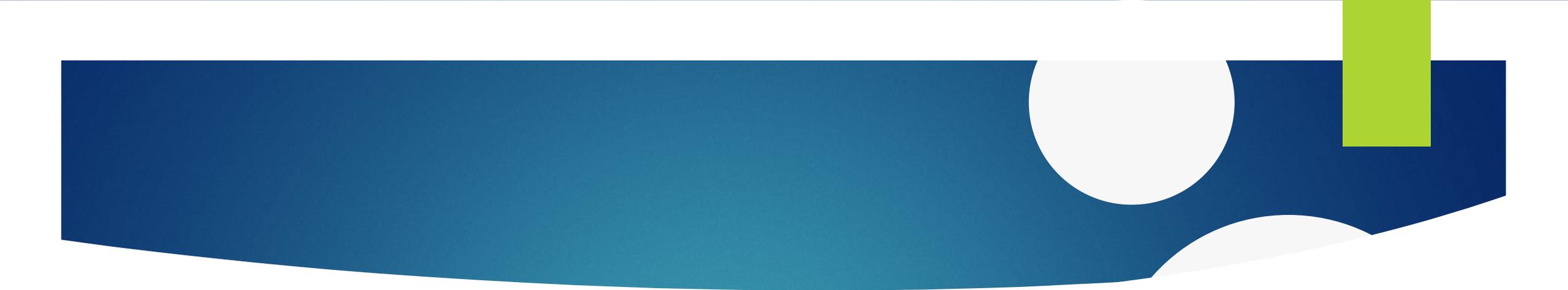
OHS is

- ▶ • Obesity (body mass index [BMI] >30 kg/m²)
- ▶ • Awake alveolar hypoventilation as indicated by a partial arterial pressure of **carbon dioxide >45** mmHg
- ▶ • Alternative causes hypercapnia and hypoventilation have been excluded



RISK FACTORS :

- 
- ▶ The major risk factor for OHS is obesity (body mass index [BMI] $>30 \text{ kg/m}^2$),
 - ▶ in particular, severe obesity (BMI $>50 \text{ kg/m}^2$),
 - ▶ where prevalence may be as high as 50 percent. However, **not all patients with obesity develop OHS**

- 
- ▶ **Risk factors in obese patients are poorly defined but may include :**
 - ▶ •Significant increase in waist:hip ratio (ie, central obesity)
 - ▶ •Reduced lung function due to obesity
 - ▶ •Reduced inspiratory muscle strength
 - ▶ •Severe obstructive sleep apnea (OSA; eg, apnea hypopnea index >50 events per hour)

Symptoms and signs

- ▶ The clinical manifestations of OHS are **nonspecific** and reflect the manifestations of obesity, coexistent obstructive sleep apnea (**OSA is present in 90 percent of OHS**) or of **OHS-related complications**:



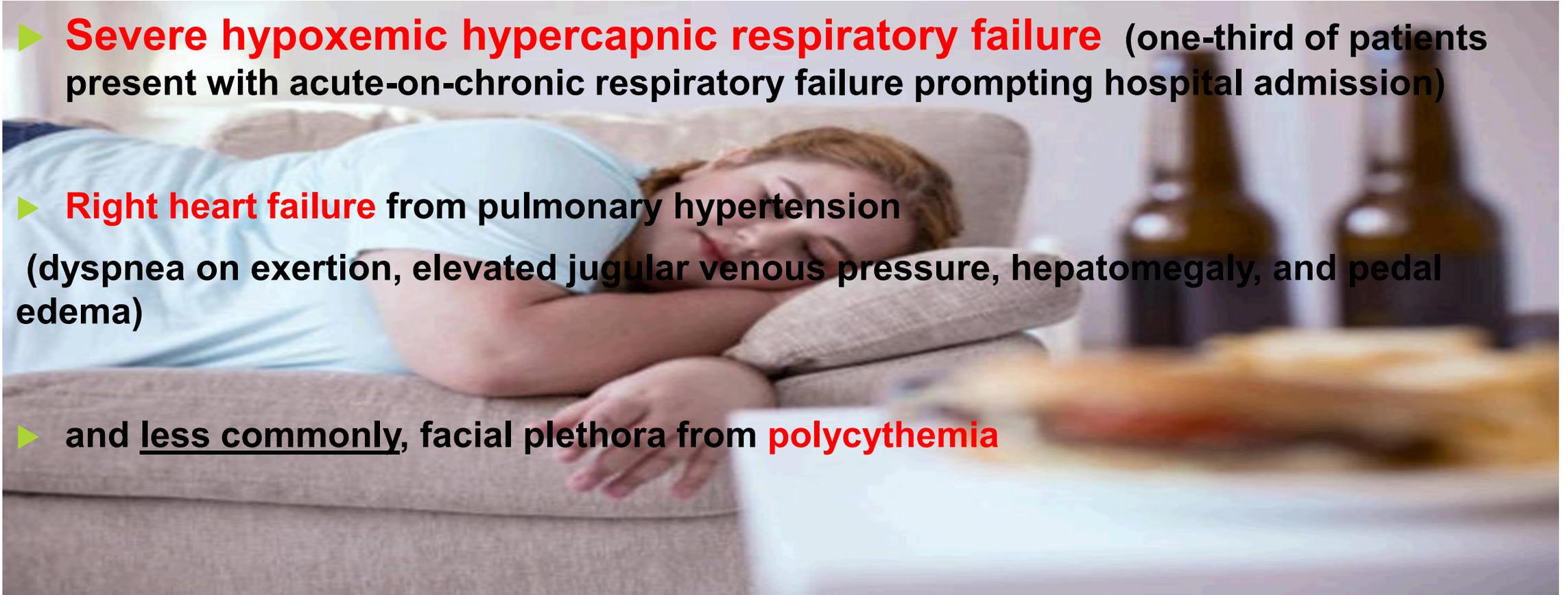
Symptoms and signs

- ▶ daytime hypersomnolence
- ▶ loud snoring
- ▶ choking during sleep
- ▶ resuscitative snorting
- ▶ fatigue
- ▶ impaired concentration and memory
- ▶ a small oropharynx, and a thick neck



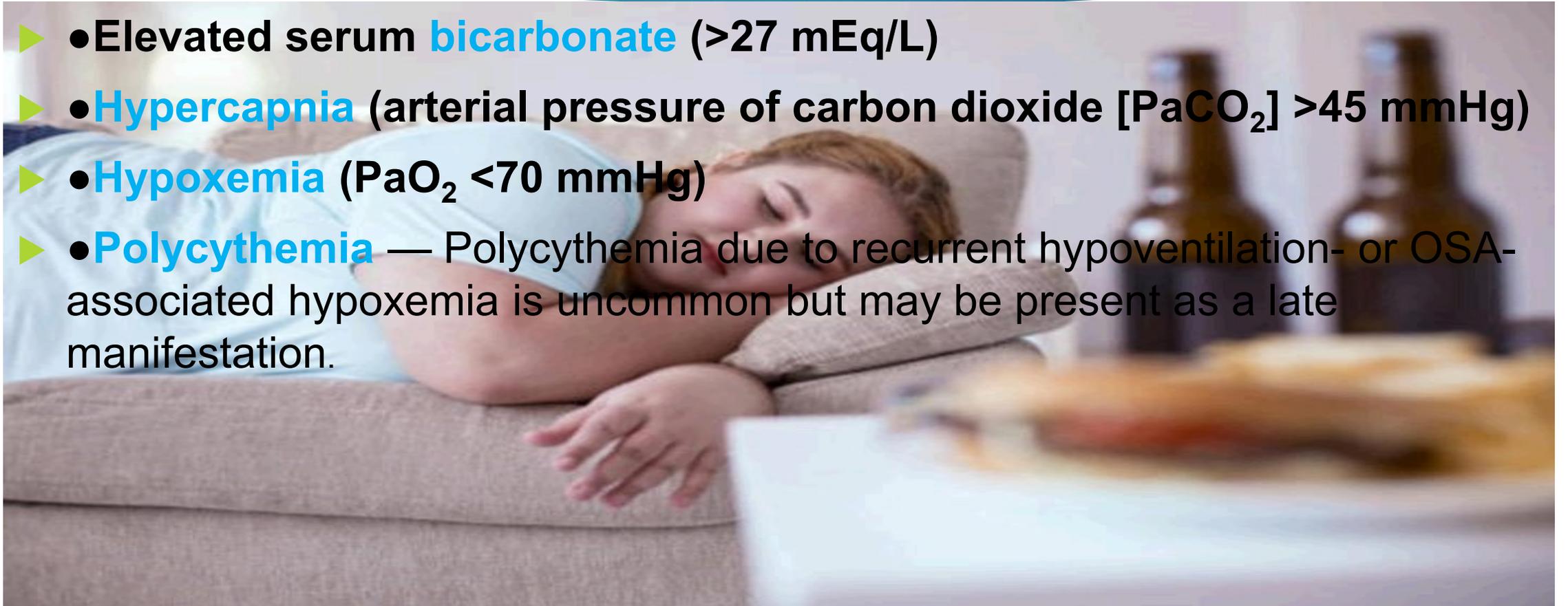
manifestations of endstage disease including

- ▶ **Severe hypoxemic hypercapnic respiratory failure** (one-third of patients present with acute-on-chronic respiratory failure prompting hospital admission)
- ▶ **Right heart failure** from pulmonary hypertension (dyspnea on exertion, elevated jugular venous pressure, hepatomegaly, and pedal edema)
- ▶ and less commonly, facial plethora from **polycythemia**



Laboratory tests

- ▶ ●Elevated serum **bicarbonate** (>27 mEq/L)
- ▶ ●**Hypercapnia** (arterial pressure of carbon dioxide [PaCO_2] >45 mmHg)
- ▶ ●**Hypoxemia** ($\text{PaO}_2 <70$ mmHg)
- ▶ ●**Polycythemia** — Polycythemia due to recurrent hypoventilation- or OSA-associated hypoxemia is uncommon but may be present as a late manifestation.



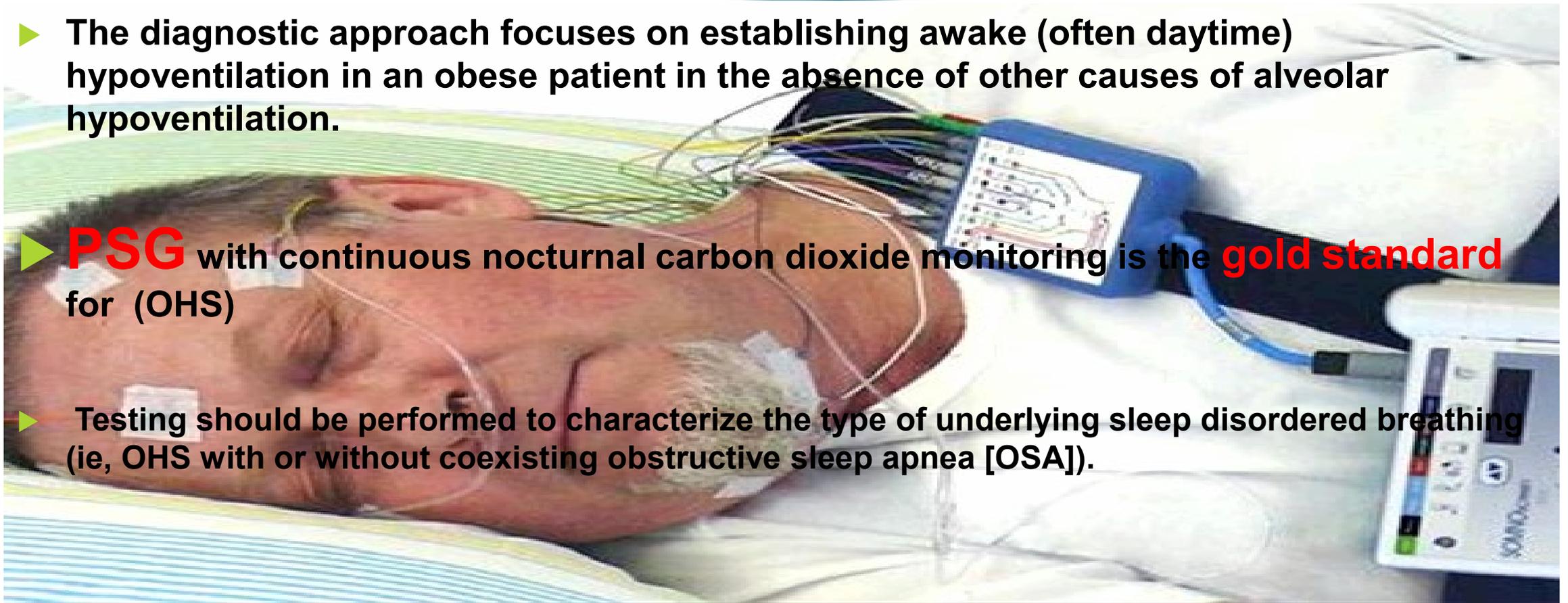
Pulmonary function tests

- ▶ In OHS a restrictive pattern on PFTs due to obesity is common
- ▶ , particularly in those with a higher BMI (eg, BMI >50 kg/m²);
- ▶ both forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁) are reduced
- ▶ while the FEV₁/FVC ratio is preserved
- ▶ . More commonly, a reduction in functional residual capacity and expiratory reserve volume is seen

- ▶ and normal pulmonary function tests (PFTs) do **not exclude** the diagnosis.
- ▶ In general, PFTs are more useful for ruling out underlying causes of hypoventilation

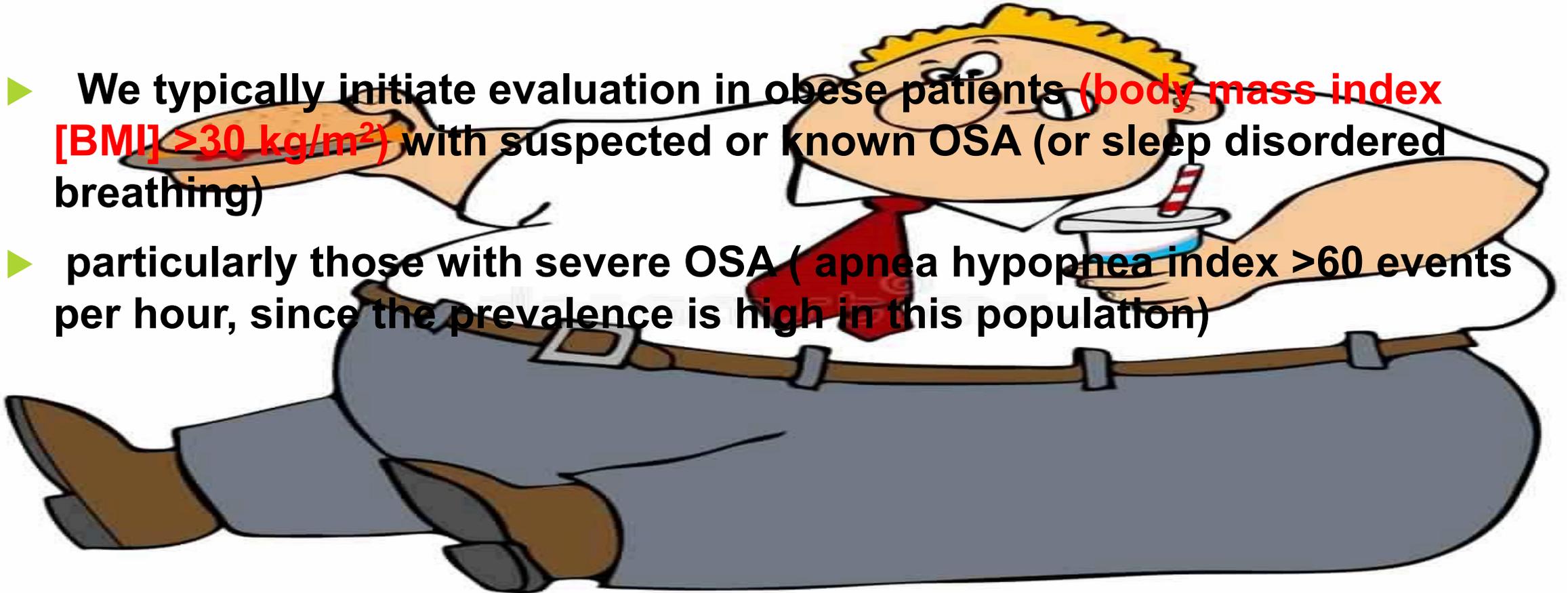
DIAGNOSTIC APPROACH

- ▶ The diagnostic approach focuses on establishing awake (often daytime) hypoventilation in an obese patient in the absence of other causes of alveolar hypoventilation.
- ▶ **PSG** with continuous nocturnal carbon dioxide monitoring is the **gold standard** for (OHS)
- ▶ Testing should be performed to characterize the type of underlying sleep disordered breathing (ie, OHS with or without coexisting obstructive sleep apnea [OSA]).



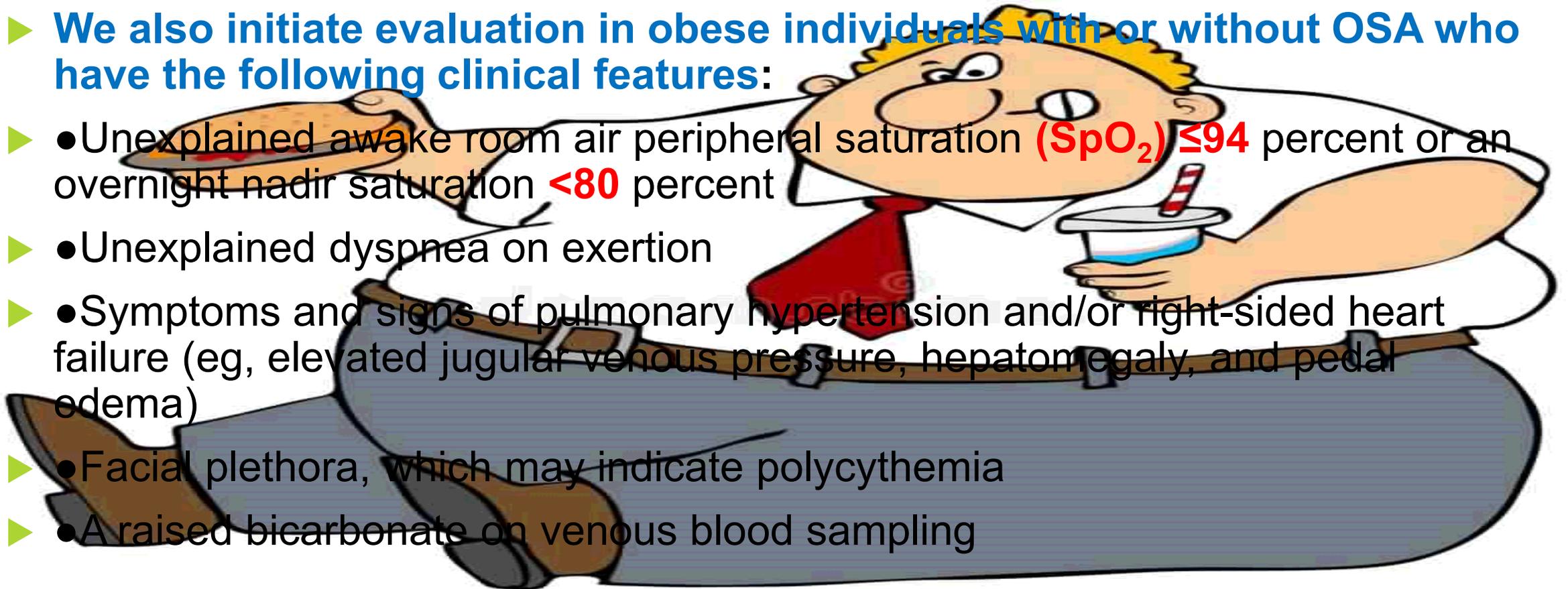
Suspecting obesity hypoventilation

- ▶ We typically initiate evaluation in obese patients (**body mass index [BMI] >30 kg/m²**) with suspected or known OSA (or sleep disordered breathing)
- ▶ particularly those with severe OSA (apnea hypopnea index >60 events per hour, since the prevalence is high in this population)



Suspecting obesity hypoventilation

- ▶ We also initiate evaluation in obese individuals with or without OSA who have the following clinical features:
 - ▶ ● Unexplained awake room air peripheral saturation (SpO_2) ≤ 94 percent or an overnight nadir saturation < 80 percent
 - ▶ ● Unexplained dyspnea on exertion
 - ▶ ● Symptoms and signs of pulmonary hypertension and/or right-sided heart failure (eg, elevated jugular venous pressure, hepatomegaly, and pedal edema)
 - ▶ ● Facial plethora, which may indicate polycythemia
 - ▶ ● A raised bicarbonate on venous blood sampling





The goals of OSA therapy



- ▶ resolve signs and symptoms of OSA,
- ▶ improve sleep quality, and normalize the apnea-hypopnea index (AHI)
- ▶ and oxyhemoglobin saturation levels.

GENERAL APPROACH

- ▶ American Academy of Sleep Medicine (**AASM**),
- ▶ the American Thoracic Society (**ATS**),
- ▶ the American College of Physicians (**ACP**),
- ▶ and the International Geriatric Sleep Medicine Force
- ▶ are recommended that, **in addition** to **the behavioral modifications** , **all patients diagnosed with OSA should be offered positive airway pressure as initial therapy.**

EDUCATION AND BEHAVIOR

- ▶ Once the diagnosis of OSA is confirmed and its severity determined,
- ▶ the results of all testing should be reviewed with the patient.
- ▶ The patient should be educated about the **risk factors, natural history, and consequences of OSA**
- ▶ , all patients should be warned about the increased risk of motor vehicle accidents associated with untreated OSA

Behavior modification

► Weight loss and exercise

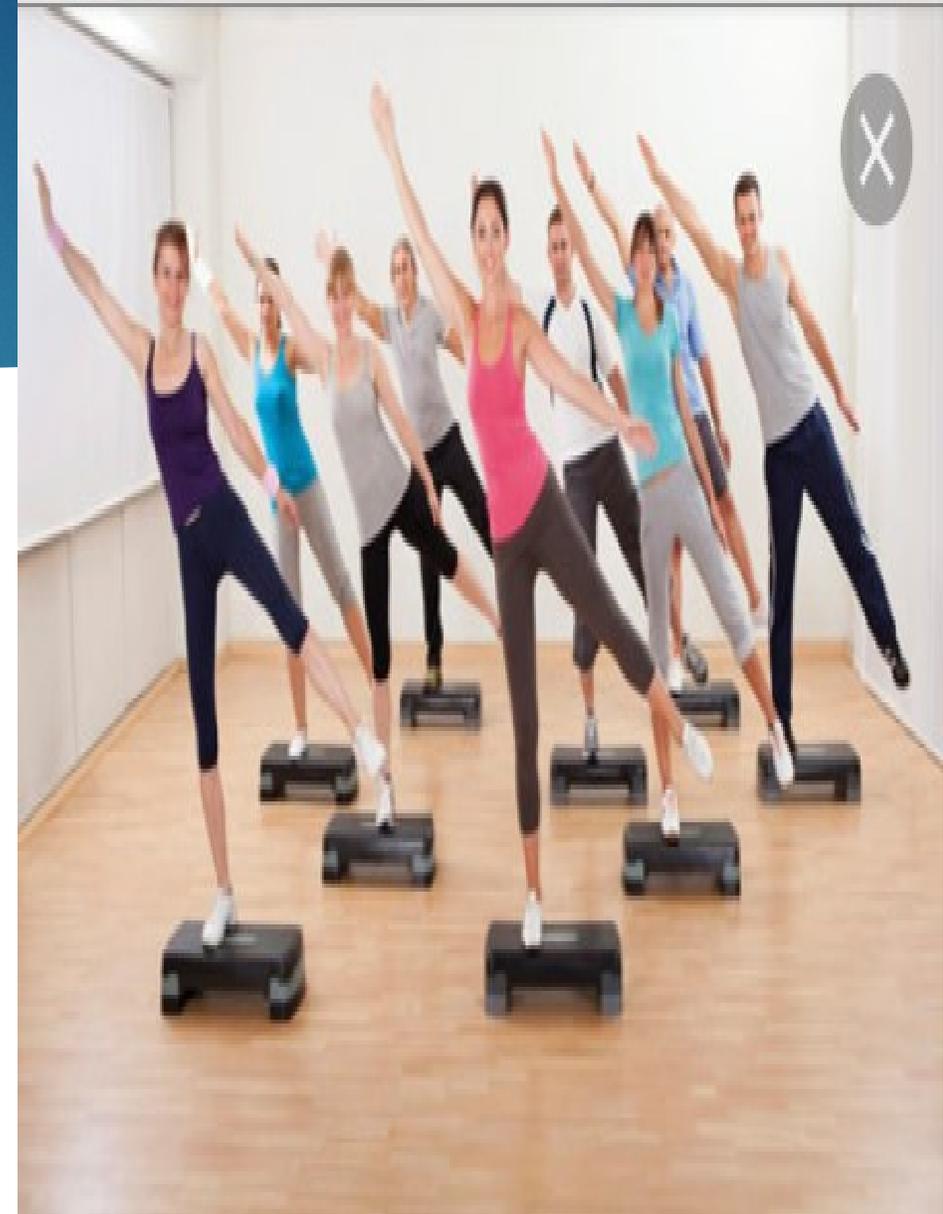


Behavior modification

- ▶ **Weight loss and exercise**
- ▶ weight loss, including that from **bariatric surgery**,
- ▶ improve overall health and metabolic parameters
- ▶ decrease the apnea-hypopnea index (AHI)
- ▶ reduce blood pressure
- ▶ improve quality of life
- ▶ and probably decrease daytime sleepiness



- ▶ Counseling regarding ongoing **diet modification** and **exercise**, as well as **referral to a nutritionist**, may be beneficial
- ▶ Exercise may modestly improve OSA even in **the absence of significant weight loss**



Behavior modification

- ▶ Weight loss and exercise
- ▶ **Sleep position**



GENERAL APPROACH

- ▶ Weight loss and exercise
- ▶ Sleep position
- ▶ **Alcohol avoidance**



Behavior modification

- ▶ Weight loss and exercise
- ▶ Sleep position
- ▶ Alcohol avoidance

- ▶ **Concomitant medications:**

benzodiazepine receptor agonists, **barbiturates**, other **antiepileptic drugs**, **sedating antidepressants**, **antihistamines**, and **opiates**.

- ▶ Antidepressants that cause **weight gain**



GENERAL APPROACH

- ▶ **Weight loss and exercise**
- ▶ **Sleep position**
- ▶ **Alcohol avoidance**
- ▶ **Concomitant medications:**
 - ▶ benzodiazepine receptor agonists, barbiturates, other antiepileptic drugs, sedating antidepressants, antihistamines, and opiates. Antidepressants that cause weight gain
- ▶ **POSITIVE AIRWAY PRESSURE THERAPY**

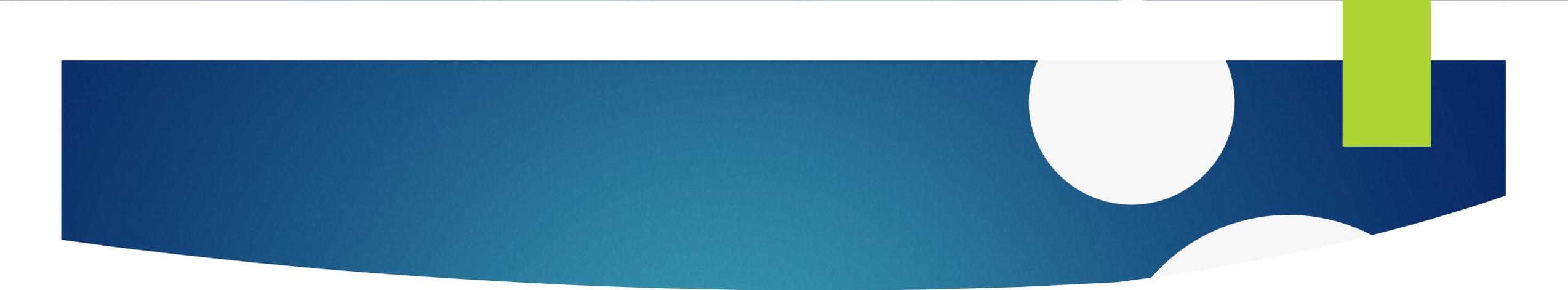


POSITIVE AIRWAY PRESSURE THERAPY



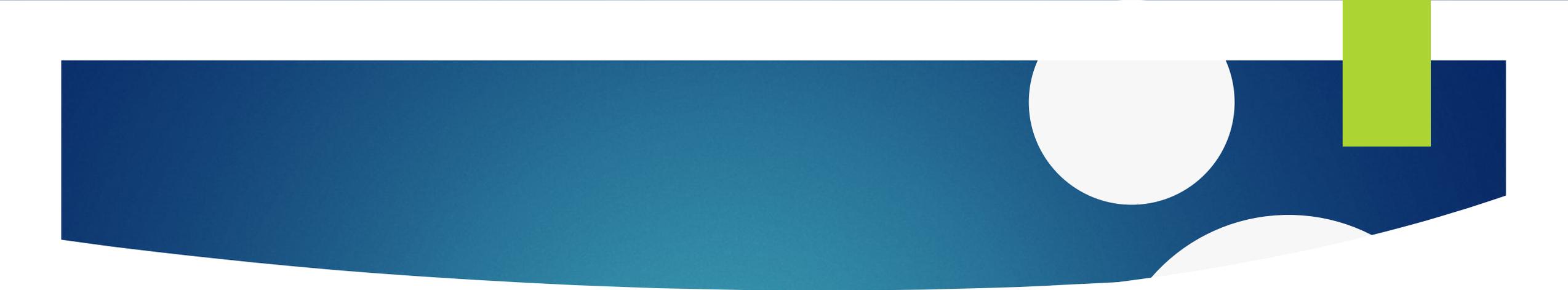
POSITIVE AIRWAY PRESSURE THERAPY

- ▶ is the **mainstay** of therapy for adults with OSA
- ▶ . The mechanism of continuous positive airway pressure (CPAP) involves maintenance of a **positive pharyngeal transmural pressure** so that the intraluminal pressure **exceeds** the surrounding pressure
- ▶ CPAP also **stabilizes** the upper airway through increased **end-expiratory lung volume**.
- ▶ As a result, respiratory events due to upper airway collapse are prevented.



▶ **positive airway pressure therapy:**

- ▶ reduces the frequency of respiratory events during sleep
- ▶ decreases daytime sleepiness,
- ▶ improves systemic blood pressure
- ▶ , lowers the risk of crashes,
- ▶ and improves quality of life across a range of disease severities
- ▶ However, no convincing **effect on mortality** has been demonstrated.

- 
- ▶ **More limited data** also suggest that positive airway pressure therapy ;
 - ▶ can improve symptoms of :
 - ▶ gastroesophageal reflux
 - ▶ heart failure outcomes,
 - ▶ and reduce the risk of recurrent atrial fibrillation and nocturnal arrhythmias

Indications for treatment:

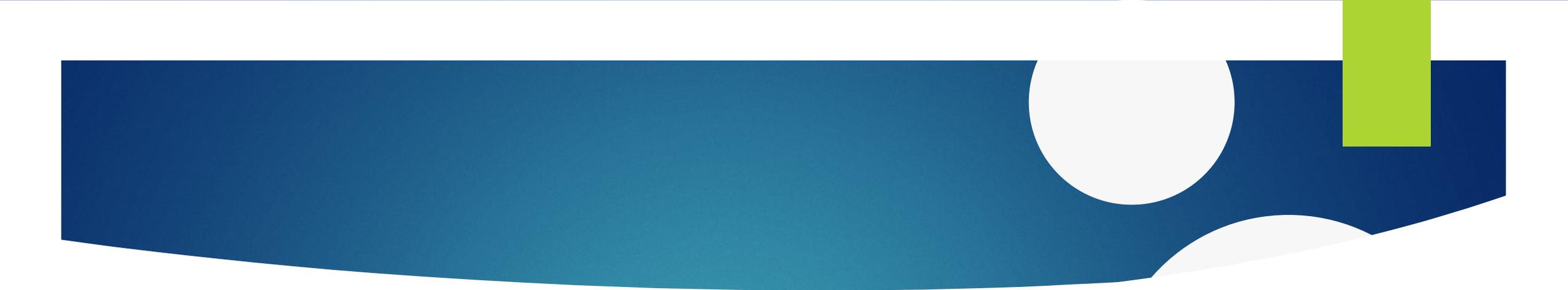
- ▶ **The American Academy of Sleep Medicine (AASM) recommends:**
- ▶ Patients with an **AHI >5** events per hour of sleep **plus** one or more clinical or physiologic sequelae attributable to OSA
- ▶ Patients with an **AHI ≥15** events per hour of sleep, even in the **absence** of symptoms.
- ▶ Patients who perform mission **critical work** (eg, airline pilots)and have an AHI between **5 and 15** events per hour of sleep, even if there are no clinical or physiological symptoms attributable to OSA.
- ▶ Patients with an **increased number of RERAs** (eg, ≥10 per hour) and excessive daytime sleepiness, even if the AHI is ≤5 events per hour.

Modes of administration

- ▶ The most common modes of positive airway pressure administration include :
 - ▶ continuous positive airway pressure (**CPAP**)
 - ▶ bilevel positive airway pressure (**BPAP**)
 - ▶ autotitrating positive airway pressure (**APAP**).

- ▶ We generally favor **CPAP** as initial therapy because it is the most familiar and best studied

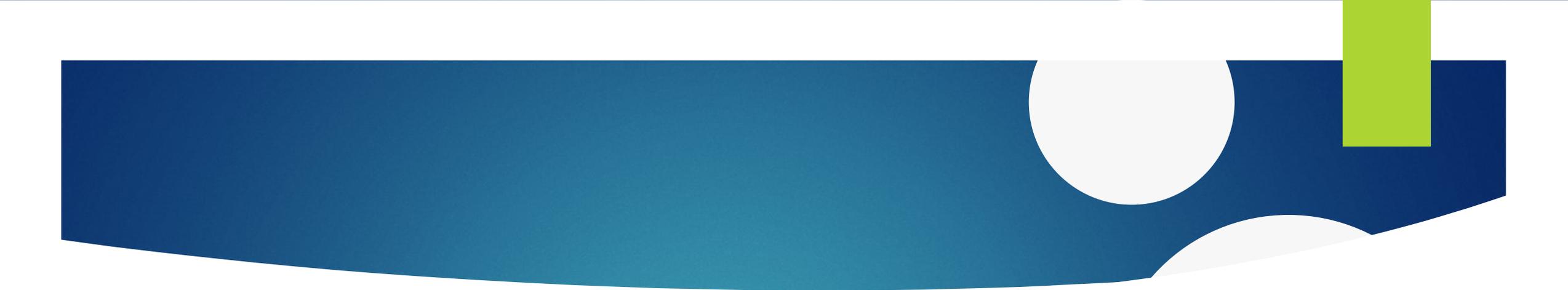


- 
- ▶ **CPAP** delivers positive airway pressure at a level that remains constant throughout the respiratory cycle.
 - ▶ It is used most often because it is **the simplest**,
 - ▶ **A pressure relief setting** (lowers the positive airway pressure at the onset of exhalation) is sometimes used to improve **comfort** and **tolerance** of the device.

- ▶ **BPAP** delivers a **preset** inspiratory positive airway pressure (**IPAP**) and expiratory positive airway pressure (**EPAP**).
- ▶ The degree of **pressure support** and consequently tidal volume is related to the **difference** between the IPAP and EPAP.

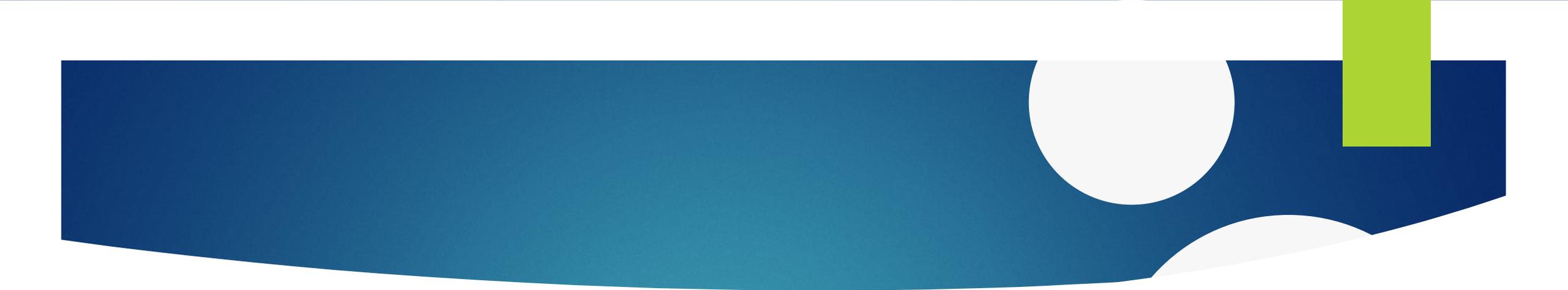




- 
- ▶ **APAP** increases or decreases the level of positive airway pressure in response to a change in airflow, a change in circuit pressure, or a vibratory snore

. The degree of improvement of major outcomes conferred by **APAP** and **CPAP** is

similar



► **It is important to note**

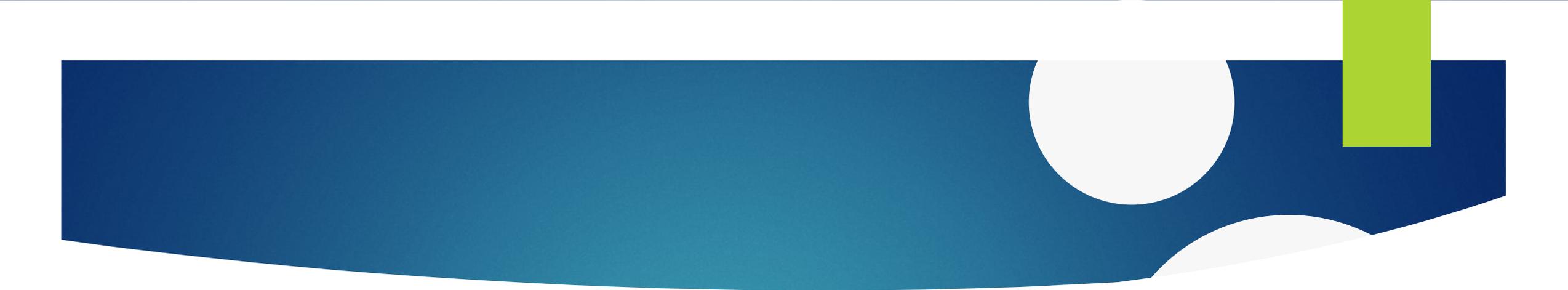
that certain patient populations have been excluded from most **auto-titrating CPAP studies**, and thus great care must be taken in considering auto-titrating CPAP in these individuals .

Patients with comorbid

- 1) congestive heart failure,
- 2) chronic obstructive pulmonary disease (COPD)
- 3) , central sleep apnea syndromes
- 4) , and hypoventilation syndromes associated with obesity,
- 5) chronic opioid use
- 6) , and neuromuscular disease affecting respiration **should be prescribed auto-titrating CPAP only after careful consideration**, if at all.

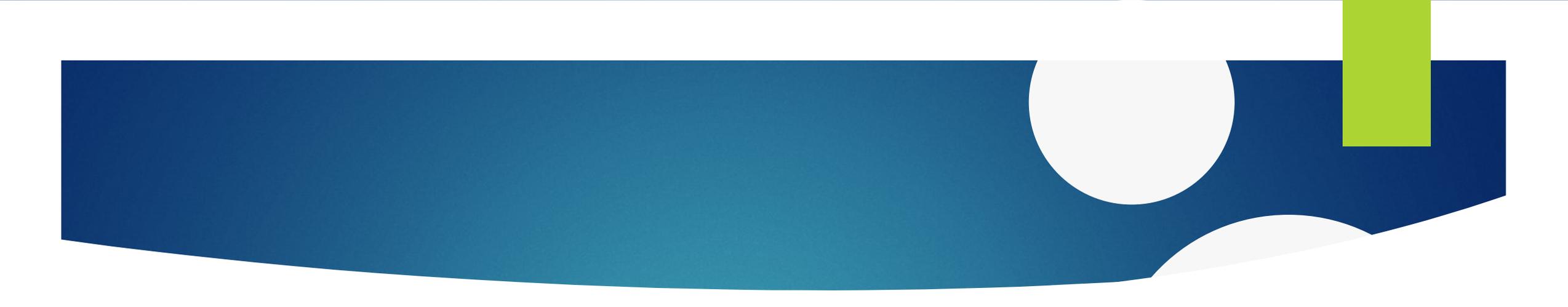
Auto-titrating CPAP has been proposed for use in three different situations

- ▶ Patients who complain of the **inability to tolerate** the degree of fixed CPAP
- ▶ Patients subjected to factors that might significantly **vary their pressure requirement**, such as use of **alcohol, nasal congestion from allergies**
- ▶ Following a diagnosis made with **HSAT**



DETERMINING THE AMOUNT OF POSITIVE AIRWAY PRESSURE

- ▶ The optimal amount of positive airway pressure (PAP) is determined by titration

- 
- ▶ **Fixed CPAP** — attended laboratory **polysomnogram (PSG)** with the patient wearing their device
 - ▶ Starting at a low level (4 cm H₂O is recommended), the amount of CPAP is serially increased (usually in increments of 1 to 2 cm H₂O) until evidence of upper airway obstruction is eliminated
 - ▶ **The recommended maximum level of PAP is 20 cm H₂O for adults; transition to BPAP should be considered if there is still upper airway obstruction at this level.**

ALTERNATIVE THERAPIES

- ▶ **Oral appliances**
- ▶ mandibular advancement devices,
- ▶ tongue retaining devices

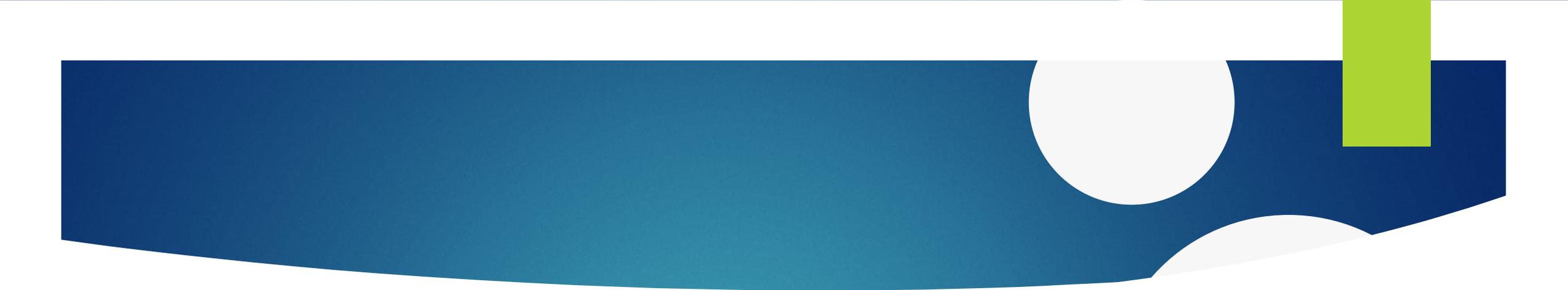


- ▶ are an alternative therapeutic strategy in OSA that may be offered to patients with **mild to moderate** OSA who **decline or fail** to adhere to positive airway pressure therapy and who have a preference for such treatment



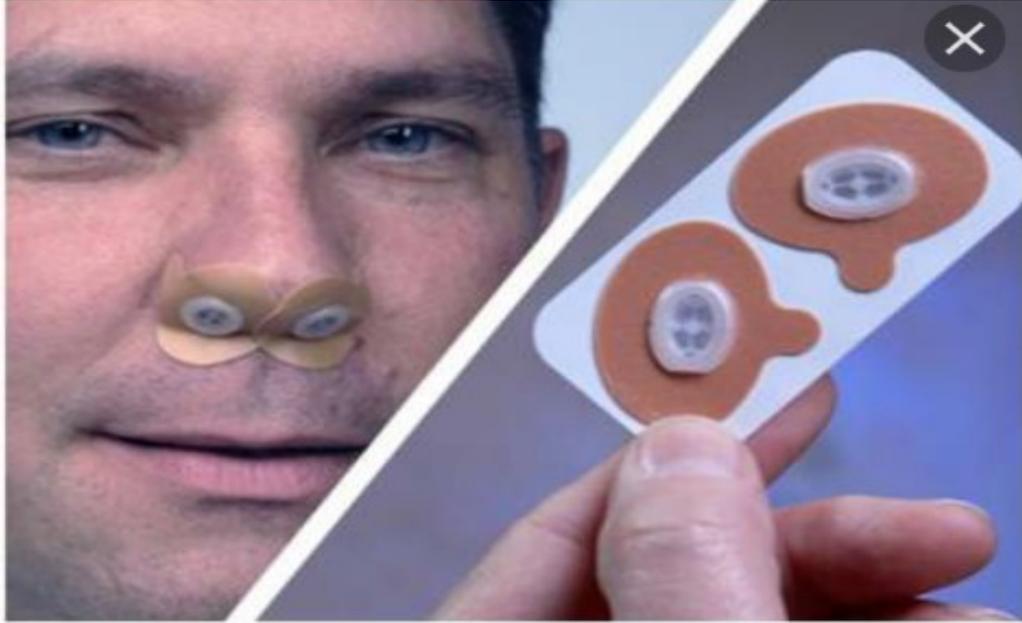
Anti Snoring Tongue (Soft Silicone)



- 
- ▶ patients with **severe OSA and/or significant sleep-related hypoxemia**
 - ▶ are **not good candidates** for an oral appliance as **first-line** therapy and should be **encouraged to use positive airway pressure therapy**

- ▶ Oral appliances **decrease** the frequency of respiratory events, arousals, and episodes of oxyhemoglobin desaturation, **compared to no treatment**
- ▶ They may also improve daytime sleepiness, quality of life
- ▶ . **Their impact on mortality is unknown**





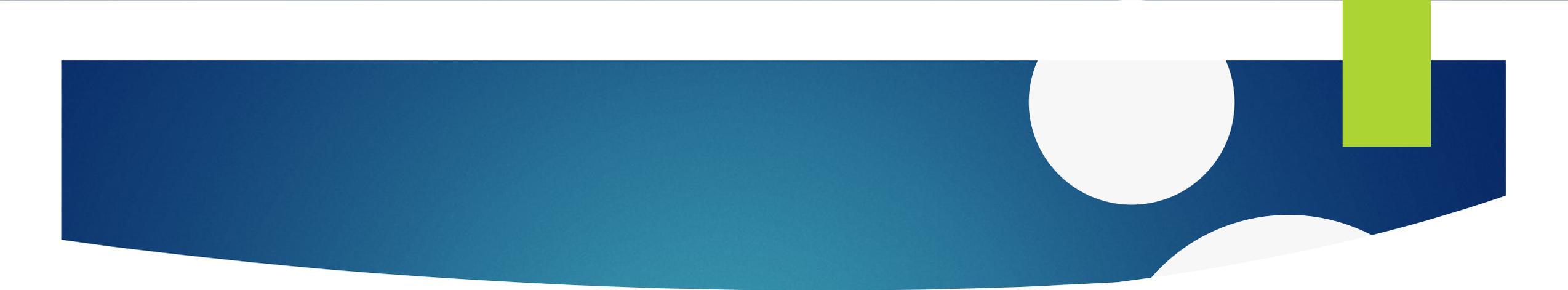
لصقات البروفنت على فتحتي الأنف





Upper airway surgery

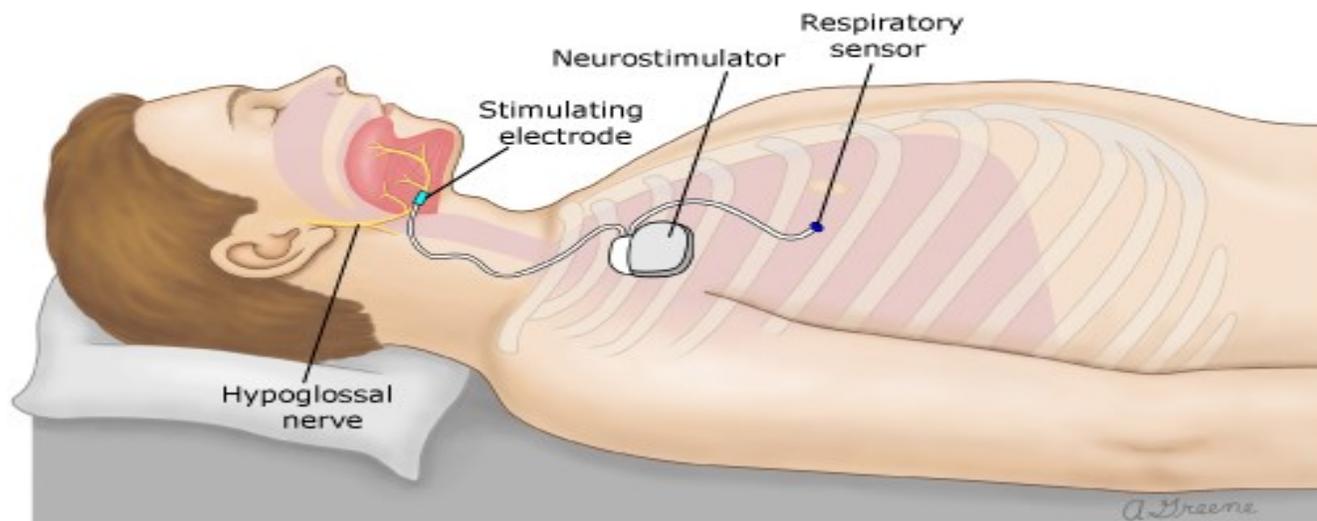
- ▶ There is **no consensus** regarding the role of surgery in patients with OSA of varying degrees of severity,
- ▶ We generally consider surgical therapy **when positive airway pressure or an oral appliance is declined or ineffective (after at least a three month trial of therapy).**
- ▶ Surgical treatment appears to **be most effective** in patients who have
- ▶ OSA due to a **severe, surgically correctable, obstructing lesion of the upper airway**
- ▶ AS tonsillar hypertrophy
- ▶ , adenoid hypertrophy,
- ▶ or craniofacial abnormalities



- ▶ **Hypoglossal nerve stimulation** via an implantable neurostimulator device is a novel treatment strategy that may have a role in selected patients with **moderate to severe OSA**,



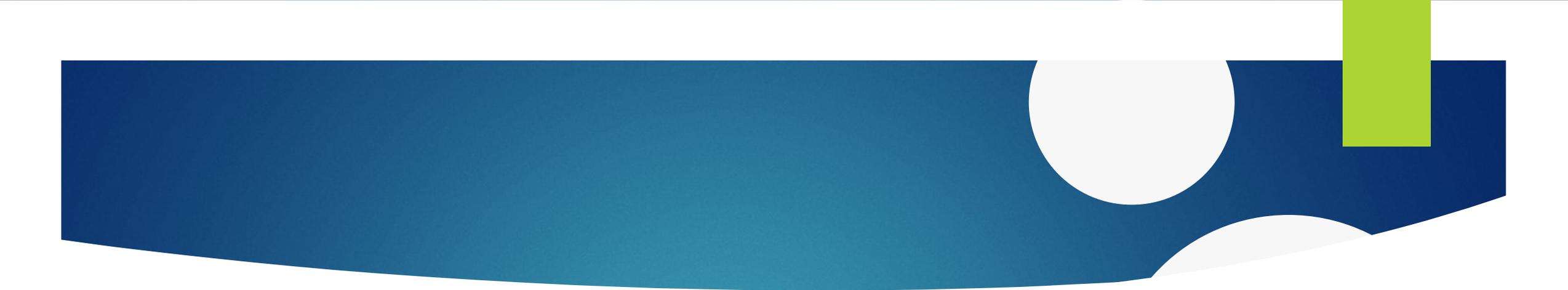
Upper airway stimulation device for obstructive sleep apnea



Pharmacologic



- ▶ A variety of pharmacologic agents have been investigated in randomized trials as **primary therapeutic** agents for the management of sleep-disordered breathing on OSA,
- ▶ This includes drugs that **might act to stimulate respiratory drive**
- ▶ Directly as **theophylline** or
- ▶ indirectly as **acetazolamide** or
- ▶ drugs that reduce upper airway collapsibility as **desipramine**.

- 
- ▶ Initial findings in a phase II study of **73** adults with **moderate or severe OSA** reported that compared with
 - ▶ **placebo**, the cannabinoid, **dronabinol** administered **one hour before bedtime** reduced the apnea-hypopnea index
 - ▶ (AHI) from **25.9 events per hour** to **15.2 events per hour (2.5 mg dose)**
 - ▶ and **13.0 events per hour (10 mg dose)**
 - ▶ . However, the mental wakefulness test scores did not improve significantly suggesting that the clinical significance of the drop in AHI is uncertain.

THANK YOU

