

Introduction to Sleep Disordered Breathing 2020

Notes by Fatimah AlTassan.

We will mainly talk about 1) OSA 2)obesity hypoventilation syndrome which is frequently misdiagnosed as COPD 3) Chyene strokes respiration, associated with heart failure

Objectives

■ Obstructive Sleep Apnea

- List the symptoms and associated comorbid conditions seen with OSA.

There are different phenotypes of OSA: aware of arousal, not aware and don't remember arousal (informed by their partner about gasping/choking/cyanosis).

- Define the polygraphic patterns associated with obstructive sleep disordered breathing.
- Describe the major treatments used for OSA.

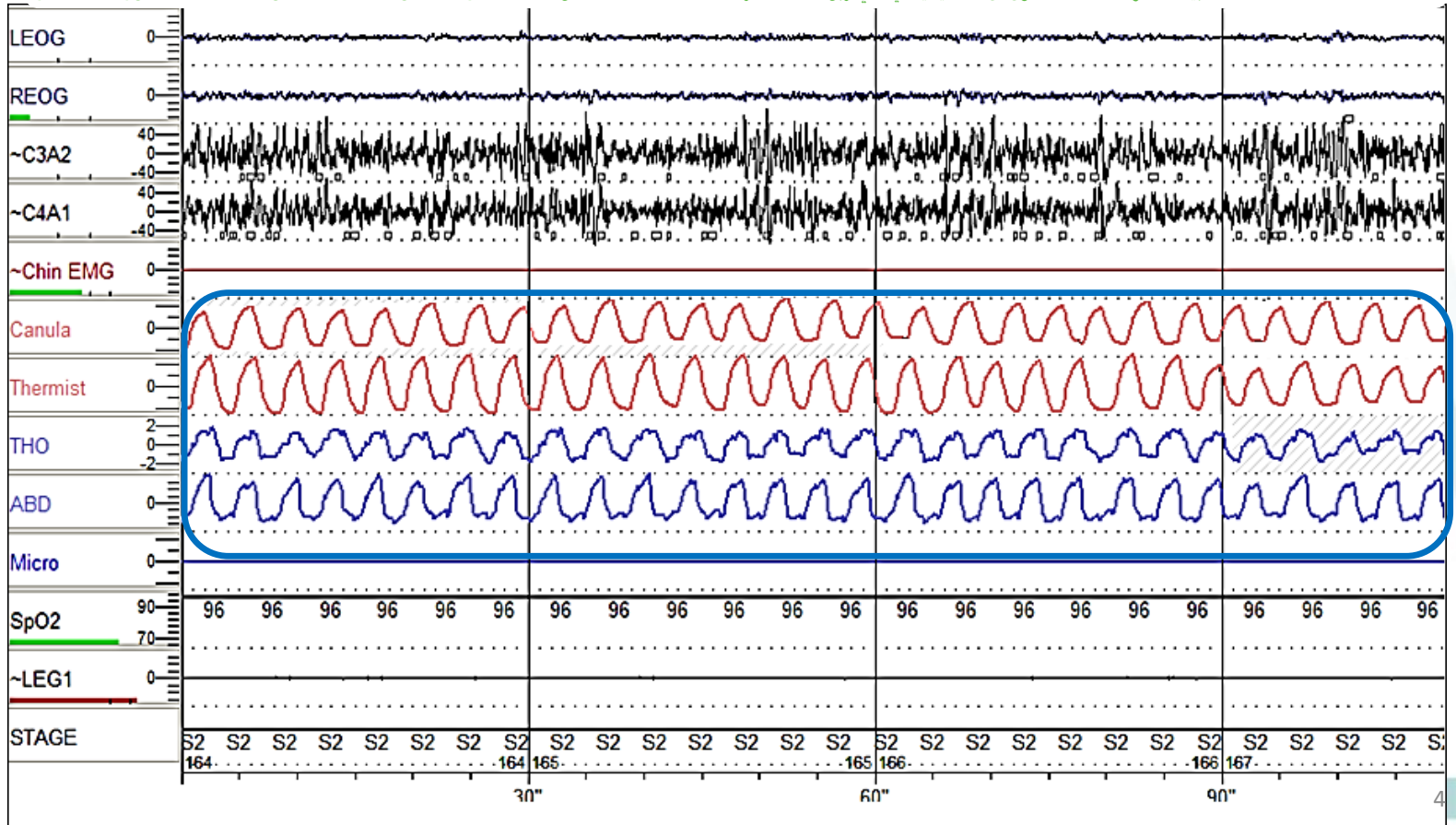
Objectives

■ Central Sleep Apnea

- Define and identify central sleep apnea.
- Describe the differences between obstructive and central sleep apnea.
- List some treatment options.

Normal Breathing

Parameters on the graph: Left eye & Right eye: help diagnosing REM sleep. C3A3&C4A1: EEG. Chin EMG: flat= atonia (help diagnosing REM sleep). Canula (nasal breathing), thermist (mouth breathing), thorax and abdomen movement: all moving together in the same phase = normal breathing. Microphone to measure snoring if present. Oxygen saturation. Leg movement. Stage if sleep. *بين الخط والخط صفحة تتكون من ٣٠ ثانية يعني هذي اربع صفحات الدراسة الكاملة ٨-٧ ساعات تطلع الف صفحة*

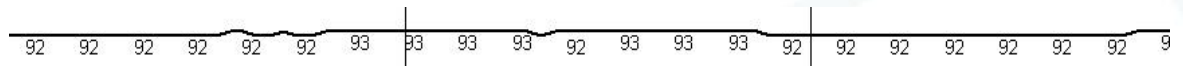




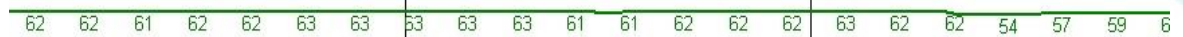
Representative Signal

- Normal Breathing

Oximetry



Heart Rate



Nasal Airflow



Effort



← 30 sec epoch →

What is Sleep Disordered Breathing?

- Is used to describe a group of disorders characterized by abnormalities of the respiratory pattern or ventilation during sleep.

Ventilation is related to CO₂ (Hypoventilation > increased CO₂ in blood)



What is Sleep Apnea?

- Defined as a cessation of airflow for a minimum of 10 seconds.

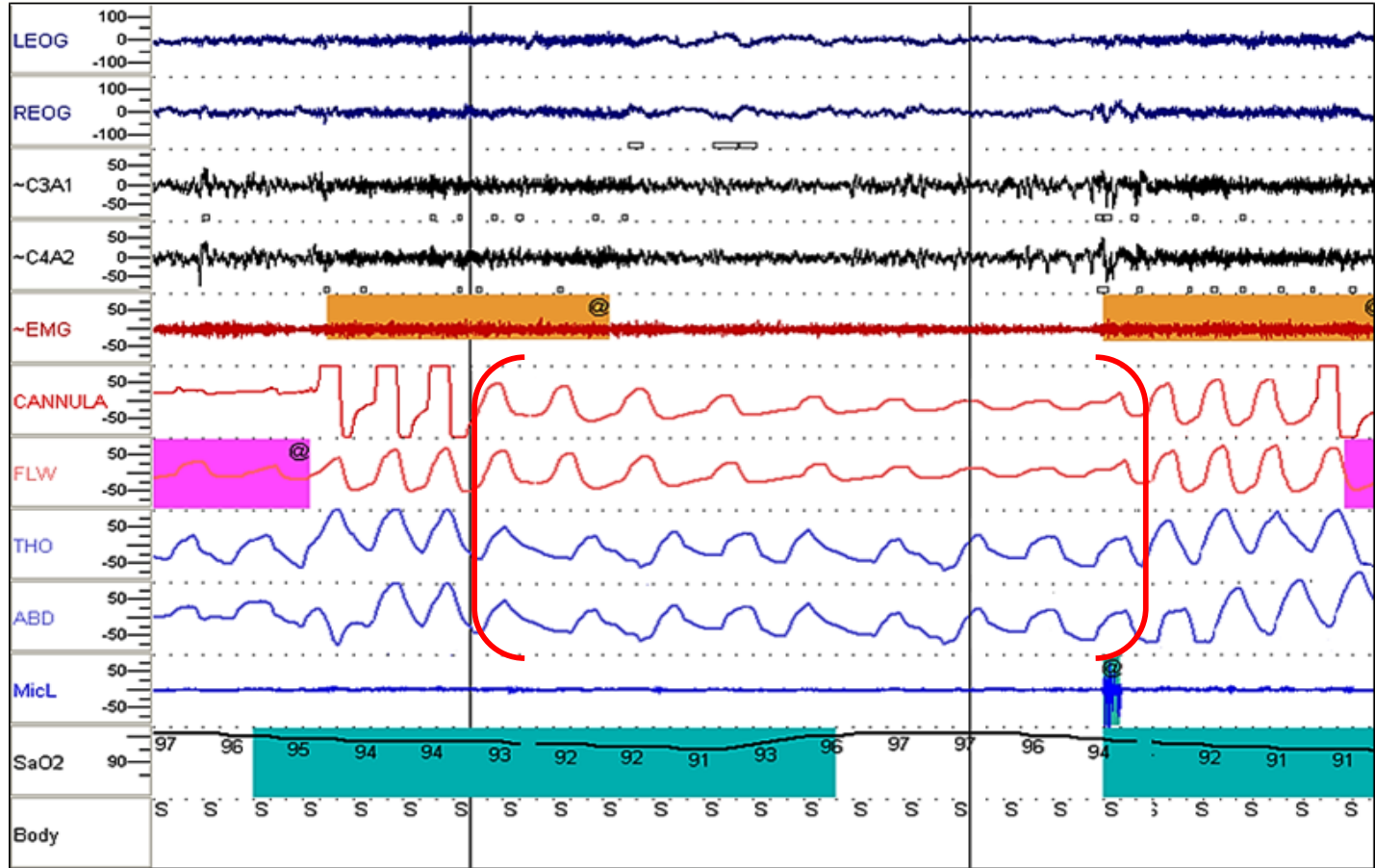


Central apnea: cessation of airflow + NO effort
OSA: upper airway closed no airflow but pt tries to breathe



Hypopnea

A(No)pnea : no breathing
Here there is Hypopnea: reduction in breathing, and desaturtaion & arousal





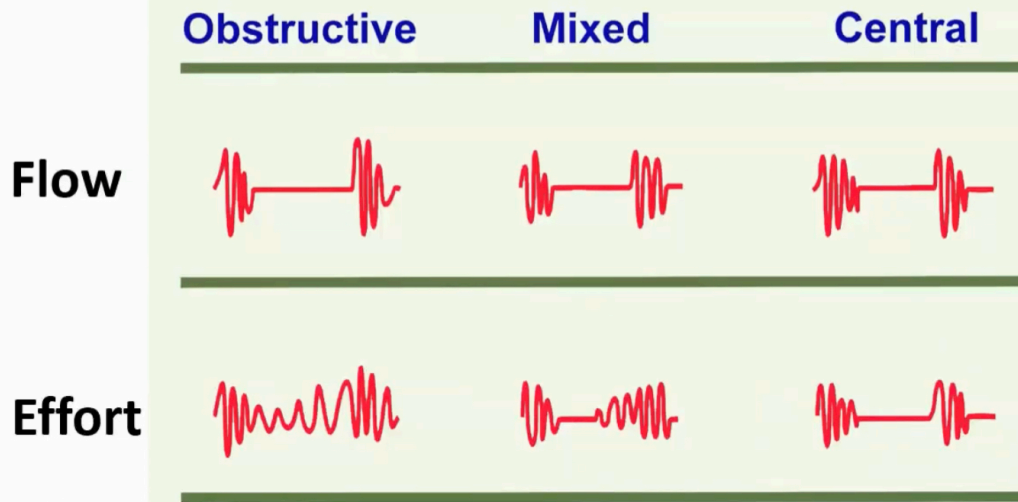
○ Categories of Sleep Apnea

- A. Obstructive Events
- B. Central Events
- C. Mixed Events



Apnea Patterns

All of 3 there's NO airflow= Apnea



There is effort but airway closed no airflow
كان أحد خانقه

brain stops breathing
No airflow + no effort



Is it familiar?

Obesity especially abdominal increases risk of OSA (fat compress diaphragm and lungs, fatty neck compresses upper airway)





○ A.) What is OSA?

- **Criteria A & B**
- **Or Criteria C**

(ICSD), 3rd ed. 2014

A.) What is OSA?

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

Symptoms of OSA:

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 disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus.

One or more of the following OSA complications:

Sleep apnea causes depression

A.) What is OSA?

AHI= (Episodes of apnea and hypopnea) / hours of sleep عدد مرات انقطاع النفس الكامل أو الجزئي بالساعة
If AHI ≥ 5 but < 15 we need the above symptoms to diagnose

B. Polysomnography (PSG) or OCST¹ demonstrates:

- ≥ 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).**

(ICSD), 3rd ed. 2014

○ A.) What is OSA?

C. PSG or OCST demonstrates:


1. **≥ 15 events predominantly obstructive respiratory events (apneas, hypopneas, or RERAs)³ per hour of sleep during a PSG or per hour of monitoring (OCST).** AHI ≥15 is diagnostic for OSA regardless of symptoms in criteria A.



OSA Severity Criteria

This criteria is for adults.
For children, one apnea per hour is considered Abnormal.

| | AHI /hr |
|-----------------|--------------------------------|
| Normal | < 5 |
| Mild | 5 - \leq15 |
| Moderate | 15 - 30 |
| Severe | > 30 |

 **Complications**
(cardiovascular stroke etc)

[Sleep](#). 1999 Aug 1;22(5):667-89.

Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. The Report of an AASM Task Force

Clinical Features of OSA

1. Nocturnal Symptoms

- Snoring
- 40% of men, 20% of women report habitual snoring
- Associated with considerable social and marital hazard



2006 American Academy of Sleep Medicine

Prevalence of Sleep Apnea

| | | |
|-------------------------|--------------------|-----------------------------|
| Young USA N = 802 | 4% Men 2% Women | AHI > 5 EDS Age 36-60 |
|-------------------------|--------------------|-----------------------------|

| | | |
|--------------------------|--------------------|--|
| Kripke USA N = 355 | 9% Men 5% Women | AHI > 15 O ₂ sat 4% Age 40-64 |
|--------------------------|--------------------|--|

| | | |
|---------------------------------|----------------------|----------------------------|
| Olson Australia N = 2,202 | 5% Men 1.2% Women | AHI \geq 15 Age 35-69 |
|---------------------------------|----------------------|----------------------------|

| | | |
|----------------------------------|---------------------|----------------------------|
| Bearpark Australia N = 400 | 10% Men 7% Women | AHI \geq 10 Age 40-85 |
|----------------------------------|---------------------|----------------------------|

Prevalence in a Saudi Sample

| | Middle-aged Saudi Men (n=578) M | Middle-aged Saudi Women (n=400) M | Netzer et al¹ (n=744) M + F | Heistand et al² (n=1506) M + F | Sharma et al³ (n=180) 80% Males |
|---|--|--|---|--|---|
| Mean age | 44.6 ± 9.8 | 43.74 — 6.31 | 48.9 ± 17.5 | 49 | -- |
| Snoring | 52.3% | 40.8 | 52.2% | 59.0% | -- |
| Day time fatigue >3 time a week | 19.3% | 9.5% | 38.8% | 26.0% | -- |
| Drowsy driving | 29.6% | | 19.9% | 32.0% | -- |
| HTN (known) | 18.0% | 24.0% | 26.0% | 29.0% | 53% |
| High risk | 32.8% | 39.0 | 37% | Males 31% Females 21% | 44.4% |

High risk means the person needs specialized medical assessment for possible OSA.

1. BaHammam et al. Saudi Med J 2008; 29: 423-426

2. BaHammam et al. Saudi Med J 2009; 30: 1572-76

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○ Prevalence of Sleep Apnea

| | |
|------------------------------------|-------------------|
| Wali et al Saudi Arabia | Men: 11.2% |
| | Women: 4% |

Otherwise snore and this
will happen to you....

Or sleep alone....

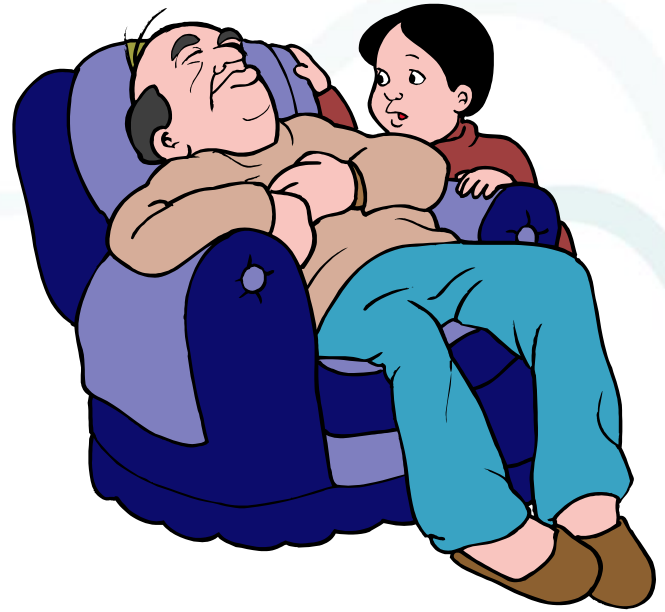


www.corbett.com.au

Clinical Features of OSA

2. Daytime Sleepiness

- Differential diagnosis includes: Rule out:
 - Insufficient Sleep Commonest cause
 - Medical and psychological disorders
 - Medications





○ Clinical Features of OSA

- **Nocturnal Choking / Gaspings**
 - Bed partners may recognize this more commonly than the patient.



Video

المركز الجامعي
لطب وأبحاث النوم
UNIVERSITY SLEEP
DISORDERS CENTER



Screening Daytime Sleepiness

The University Sleep Disorders Center King Khalid University Hospital



Epworth Sleepiness Scale

- 0 = would less than once a month doze
- 1 = slight chance of dozing
- 2 = moderate chance of dozing
- 3 = high chance of dozing

Score ≥ 10 indicates daytime sleepiness in the past month

بنود

| Situation | Chance of Dozing | | | |
|--|------------------|---|---|---|
| Sitting and Reading | 0 | 1 | 2 | 3 |
| Watching TV | 0 | 1 | 2 | 3 |
| Sitting inactive in a public place (in awaiting area or in a meeting) | 0 | 1 | 2 | 3 |
| As passenger in a car for an hour without a break | 0 | 1 | 2 | 3 |
| Lying down to rest in the afternoon when circumstances permit | 0 | 1 | 2 | 3 |
| Sitting and talking to someone | 0 | 1 | 2 | 3 |
| Sitting quietly after a lunch | 0 | 1 | 2 | 3 |
| In a car, while stopped for a few minutes in the traffic | 0 | 1 | 2 | 3 |
| Total score | | | | |
| How long have you been like this (months/ year) | | | | |

Screening Daytime Sleepiness

Epworth Sleepiness Scale

- صفر : أقل من مرة في الشهر
1 : قليلة الحدوث
2 : متوسطة الحدوث
3 : تحدث بكثرة

| فرص أن تغفو أو تنام | | | الحالــــــــــــــــة |
|---------------------|---|---|--|
| 3 | 2 | 1 | الجلوس للقراءة |
| 3 | 2 | 1 | مشاهدة التلفزيون |
| 3 | 2 | 1 | الجلوس بمكان عام دون عمل شيء (في صالة انتظار أو في اجتماع) |
| 3 | 2 | 1 | عندما تستقل سيارة كراكب في رحلة مدتها أكثر من ساعة بدون توقف |
| 3 | 2 | 1 | الاسترخاء بعد الظهر (عندما تسمح الظروف) |
| 3 | 2 | 1 | خلال الجلوس والمحادثة مع شخص ما |
| 3 | 2 | 1 | الاستراحة بعد الغداء |
| 3 | 2 | 1 | في السيارة عند التوقف لوضع دقائق خلال زحمة السير |
| | | | مجموع التقييم |
| | | | منذ متى يحدث لك ذلك؟ (أشهر/سنوات) |



Stanford Sleepiness Scale (SSS)

The Stanford Sleepiness Scale

Please record the scale value that best describes your state of sleepiness:

1. Feeling active and vital; alert; wide awake
2. Functioning at a high level, but not at peak; able to concentrate
3. Relaxed; awake; not at full alertness; responsive
4. A little foggy; not at peak; let down
5. Fogginess; beginning to lose interest in remaining awake; slowed down
6. Sleepiness; prefer to be lying down; fighting sleep; woozy
7. Almost in reverie; sleep onset soon; lost struggle to remain awake

SSS scores range from 1 to 7, with increasing scores indicating increased sleepiness.

From Hoddes E, Dement WC, Zarcone V. The history and use of the Stanford Sleepiness Scale [abstract]. *Psychophysiology* 1972;9:150; with permission.



STOP BANG QUESTIONNAIRE

PERSONAL PROFILE

No.: _____ PSG S No: _____ Nationality: Saudi Non Saudi

Age (Years): _____ Height(cm): _____ Weight. (Kgs): _____

Neck Size (cm): _____ Occupation: _____

Marital Status: Single Married Divorced AHI: _____

Hospital Name: _____ City: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS POSSIBLE. WHERE APPLICABLE, PLACE A CHECK MARK (✓) NEXT TO THE BEST ANSWER:

| | | |
|---|---------------------------|--------------------------|
| S nooring? Do you Snore Loudly (louder than talking or loud enough to be heard through closed doors)? | <input type="radio"/> Yes | <input type="radio"/> No |
| T ired? Do you often feel Tired, Fatigued, or Sleepy during the daytime? | <input type="radio"/> Yes | <input type="radio"/> No |
| O bserved? Has anyone observed you Stop Breathing during your sleep? | <input type="radio"/> Yes | <input type="radio"/> No |
| P ressure? Do you have or are being treated for High Blood Pressure ? | <input type="radio"/> Yes | <input type="radio"/> No |
| B ody Mass Index BMI is more than 35? | <input type="radio"/> Yes | <input type="radio"/> No |
| A ge Age older than 50? | <input type="radio"/> Yes | <input type="radio"/> No |
| N eck size large? Do you have a Neck that Measures more than 16 inches / 40 cm around (measure at Adam's Apple)? | <input type="radio"/> Yes | <input type="radio"/> No |
| G ender Male? Male= higher score | <input type="radio"/> Yes | <input type="radio"/> No |



استبيان STOPBANG

البيانات الشخصية

الرقم: _____ الجنسية: سعودي غير سعودي الترح: _____

العمر (سنوات): _____ الوزن (كيلو): _____ الطول (سم): _____

قياس محيط الرقبة (سم): _____ الوظيفة الحالية: _____

الحالة الاجتماعية: غير متزوج متزوج مطلق

البلد: _____ اسم المستشفى: _____

الرجاء الإجابة على الأسئلة أدناه لتحديد ما إذا كانت مبرحاً للإصابة بتوقف التنفس أثناء النوم ، الرجاء الإجابة بدقة قدر الإمكان بوضع علامة ✓ بجانب الإجابة :

| | | | |
|----------------------------|--|---------------------------|--------------------------|
| الشخير: | هل تشخر بصوت عالٍ (أعلى من صوت الكلام للحداد ، أو أن شخيرك على بدرجة كافية يفسح من وراء الأبواب المغلقة) ؟ | <input type="radio"/> نعم | <input type="radio"/> لا |
| الشعور بالتعب: | هل تشعر غالباً بالتعب أو الإرهاق أو النعاس خلال النهار؟ | <input type="radio"/> نعم | <input type="radio"/> لا |
| الملاحظة: | هل لاحظ أي شخص من قبل أن تنفسك قد توقف خلال نومك؟ | <input type="radio"/> نعم | <input type="radio"/> لا |
| الحمض: | هل تعاني من ارتفاع ضغط الدم أو هل تتناول علاج لارتفاع الضغط؟ | <input type="radio"/> نعم | <input type="radio"/> لا |
| مؤشر كتلة الجسم أعلى من 35 | يتم حساب ذلك بقسمة الوزن مقسراً بالمتكوبوم على مربع الطول مقسراً بالتر | <input type="radio"/> نعم | <input type="radio"/> لا |
| العمر | هل عمرك 50 عاماً أو أكثر؟ | <input type="radio"/> نعم | <input type="radio"/> لا |
| قياس محيط الرقبة: | هل قياس محيط رقبتك أكثر من ١٦ بوصة أو حوالي ٤٠ سم؟ (يتم قياسها من مستوى فتحة آدم) | <input type="radio"/> نعم | <input type="radio"/> لا |
| الجنس = ذكر: | | <input type="radio"/> نعم | <input type="radio"/> لا |

BERLIN QUESTIONNAIRE

Height (m) _____ Weight (kg) _____ Age _____ Male / Female

Please choose the correct response to each question.

CATEGORY 1

1. Do you snore?

- a. Yes
- b. No
- c. Don't know

If you snore:

2. Your snoring is:

- a. Slightly louder than breathing
- b. As loud as talking
- c. Louder than talking
- d. Very loud – can be heard in adjacent rooms

3. How often do you snore

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

4. Has your snoring ever bothered other people?

- a. Yes
- b. No
- c. Don't Know

5. Has anyone noticed that you quit breathing during your sleep?

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

CATEGORY 2

6. How often do you feel tired or fatigued after your sleep?

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

7. During your waking time, do you feel tired, fatigued or not up to par?

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?

- a. Yes
- b. No

If yes:

9. How often does this occur?

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

CATEGORY 3

10. Do you have high blood pressure?

- Yes
- No
- Don't know

استبانة بوليز

الاسم: _____ رقم الملف: _____ الطول (بالمتر) _____
الوزن (كغ): _____ العمر: _____ ذكراً/ أنثى _____

الرجاء اختيار الرد الصحيح لكل سؤال فيما يلي:

الفئة الأولى:

1. هل تنفخ؟

- أ. نعم
 ب. 4-7
 ج. 7-10
 د. لا يحدث

(إذا كنت تنفخ):

2. كيف يمكن أن تصف ارتفاع صوت تنفخك:

- أ. أعلى من صوت التنفس
 ب. نفس درجة ارتفاع التنفس
 ج. أعلى من التنفس
 د. مرتفع جداً - يمكن سماعه من غرف المجاورة

3. كم مرة يتكرر تنفخك؟

- أ. كل يوم تقريباً
 ب. 3-4 مرات بالأسبوع
 ج. مرة إلى مرتين بالأسبوع
 د. مرة إلى مرتين بشهر
 هـ. 7 مرات يحدث

1

4. هل سبق وأن سبب تنفخك الإزعاج لأحد؟

- أ. نعم
 ب. 4-7
 ج. 7-10
 د. لا يحدث

5. هل لاحظ أي شخص أنك توقف التنفس أثناء النوم؟

- أ. تقريباً كل يوم
 ب. 3-4 مرات بالأسبوع
 ج. مرة إلى مرتين بالأسبوع
 د. مرة إلى مرتين بشهر
 هـ. لا يحدث

الفئة الثانية:

6. كم مرة تشعر بالتيب أو الإرهاق عند الاستيقاظ من النوم؟

- أ. كل يوم تقريباً
 ب. 3-4 مرات بالأسبوع
 ج. مرة إلى مرتين بالأسبوع
 د. مرة إلى مرتين بشهر
 هـ. لا يحدث

7. هل تفسن بالتيب أو الإرهاق أثناء ساعات اليقظة؟

- أ. كل يوم تقريباً
 ب. 3-4 مرات بالأسبوع
 ج. مرة إلى مرتين بالأسبوع
 د. مرة إلى مرتين بشهر
 هـ. لا يحدث

2



8. هل سبق أن نعتت أو ننت خلال قيادة السيارة أو الاقطار (طبخ) مثلا؟

أ. نعم

ب. لا

إذا كتبت الإجابة نعم:

9. كم مرة يحدث هذا:

أ. كل يوم تقريبا

ب. 4-3 مرات بالأسبوع

ج. مرة إلى مرتين بالأسبوع

د. مرة إلى مرتين بشهر

هـ. لا يحدث

الفئة الثالثة:

10. هل أنت مصاب بارتفاع ضغط الدم؟

أ. نعم

ب. لا

ج. لا أعرف

WHAT ARE THE RISK FACTORS?

○ Risk Factors of OSA

1. Structural Abnormalities:

- Short Fat Neck

(Neck circumference $>17''/16''$)

M F



○ Risk Factors of OSA

- Small Mandible

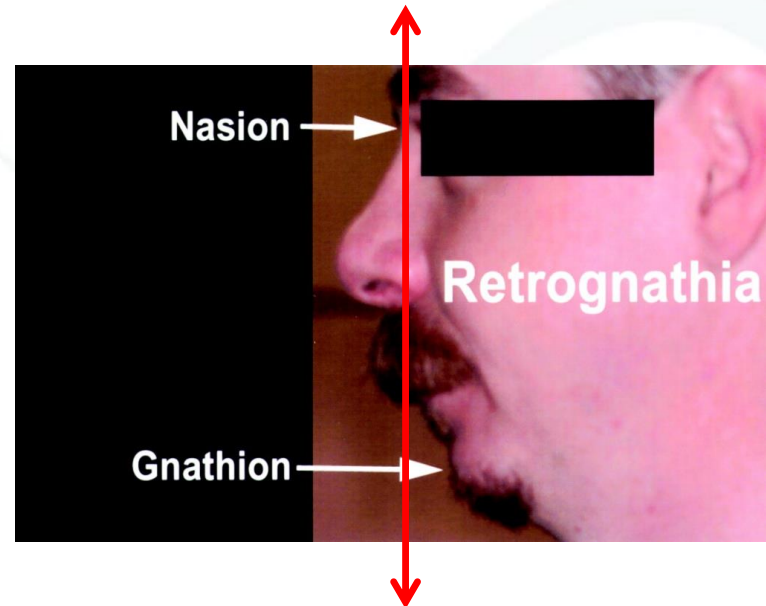
The mandible is the bed of the huge genioglossus muscle if mandible is small it pushes everything backward to the posterior pharyngeal wall > airway closure



Risk Factors of OSA

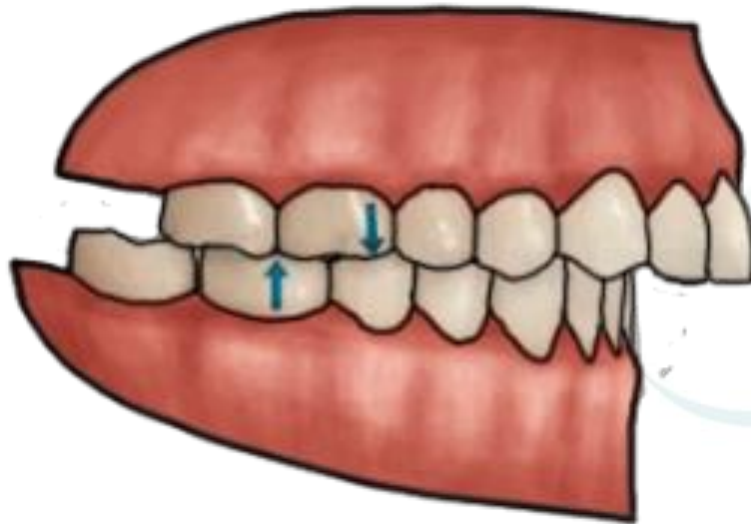
- **Retrognathia**

Genioglossus muscle pushed backward



Overbite

Overbite causes OSA if the person is thin



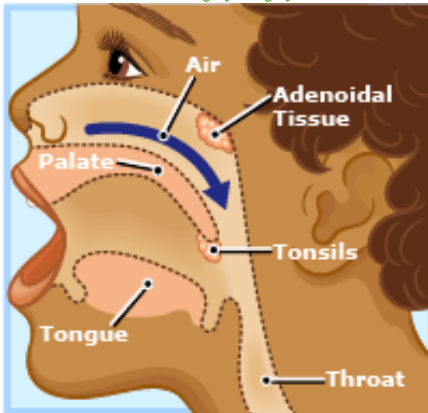


Risk Factors of OSA

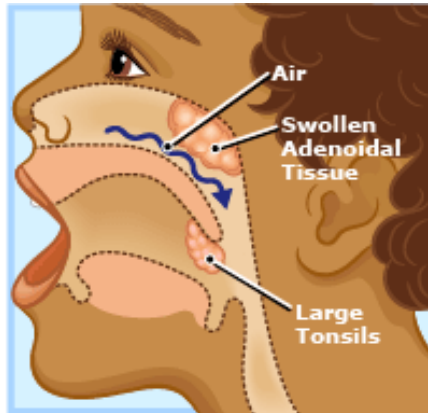
2. Upper airway narrowing:

- Large tonsils / adenoids

Features of Children with OSA and large tonsils/adenoids: open mouth, protruded tongue, snoring, strange sleeping position
كانهم ساجدين عشان يفتحون مجرى الهواء
Hyperactive inattentive -ADHD misdiagnosis. In contrast to adults daytime somnolence.
In children surgery is highly effective.



Normal Anatomy
Open airways allow air to flow easily.



Common Causes of Sleep Apnea
Large tonsils and adenoids make airflow more difficult.



Kissing tonsils

Dr. P. Marazzi/Photo Researchers, Inc.



Sleep apnea and children
www.dcsmls.com/services/sleep-apnea/sleep-and-children/



Cont..

(Upper airway narrowing)

- Long uvula

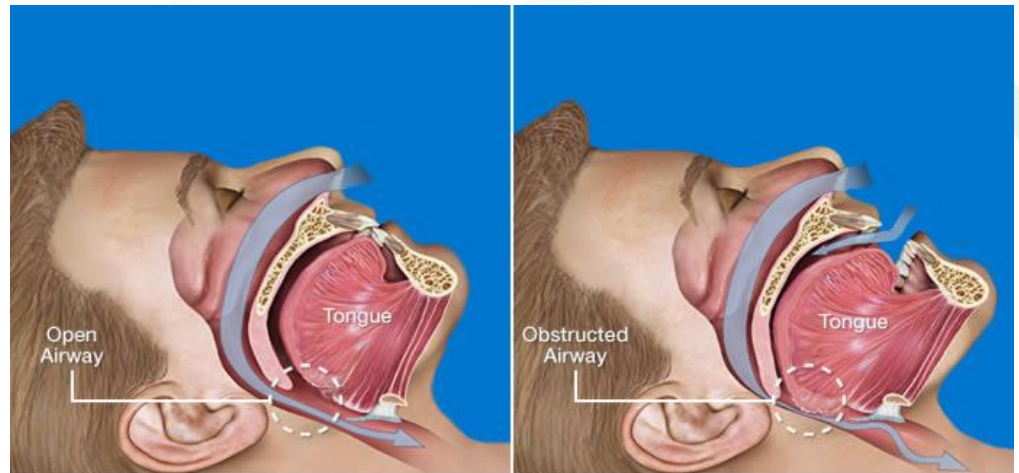




Large tongue



Large tongue with teeth marking on the tongue.



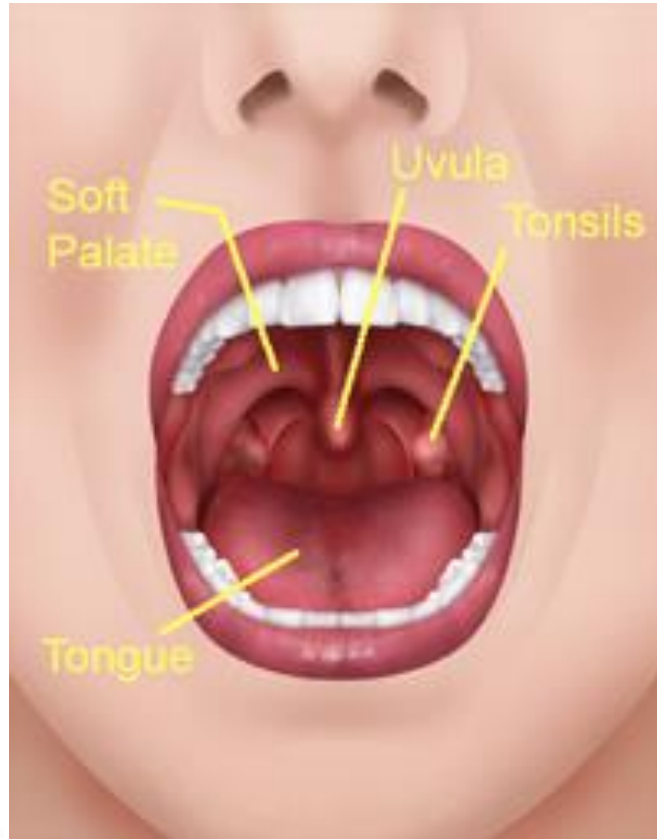
Non-Obstructed Airway

Obstructed Airway



Cont..

(Upper airway narrowing)



Cont..

(Upper airway narrowing)

Modified mallampati

Mallampati Score to Help Predict Obstructive Sleep Apnea



Mallampati I

Uvula seen



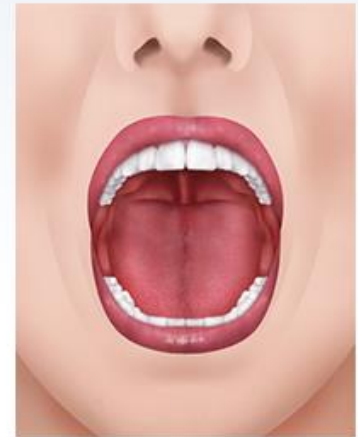
Mallampati II

Cant see tip of uvula



Mallampati III

Only base of uvula



Mallampati IV

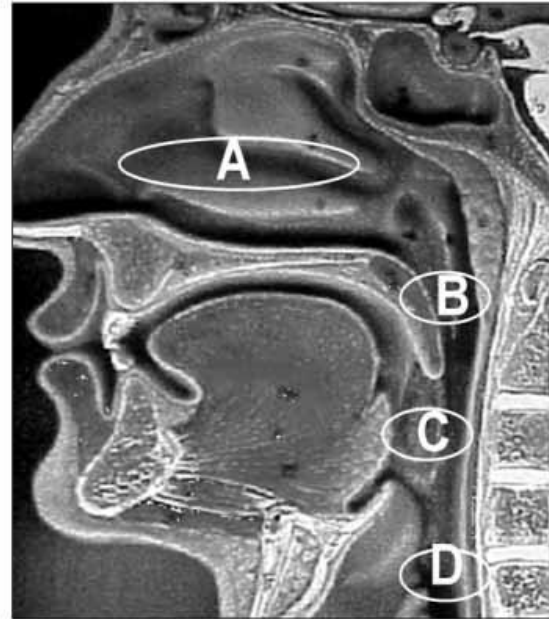
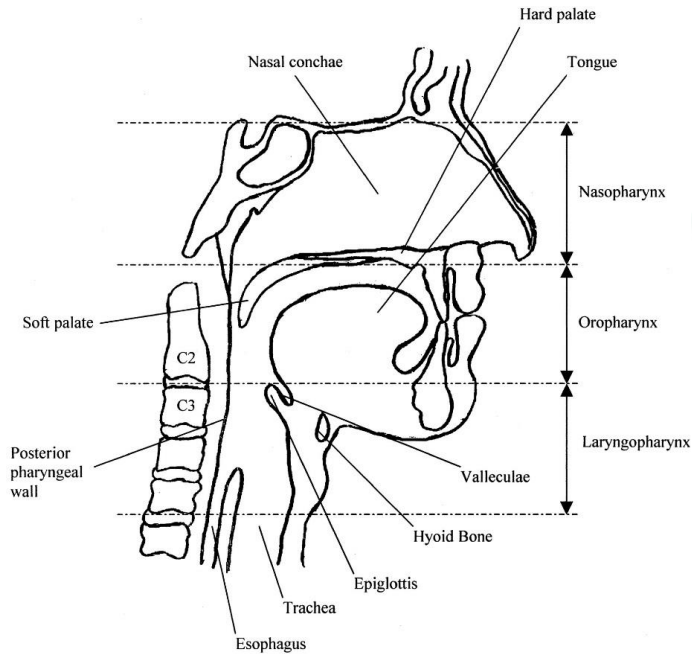
Uvula not visualized at all

Many adults with mallampati 4 have retrognathia > tongue displaced backward obscuring the soft palate



Levels of airway obstruction

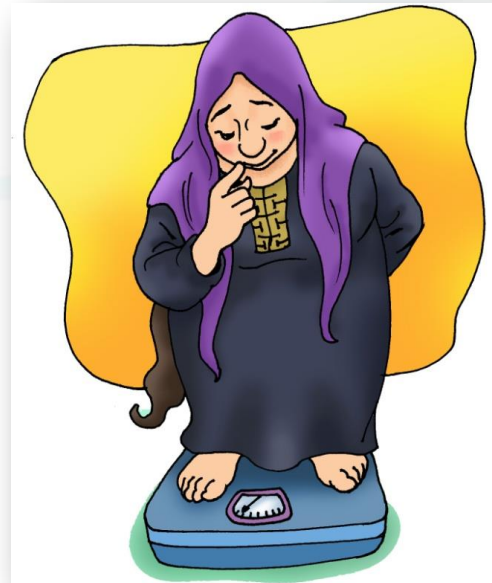
Levels at:
Soft palate & uvula
Tongue
More distal



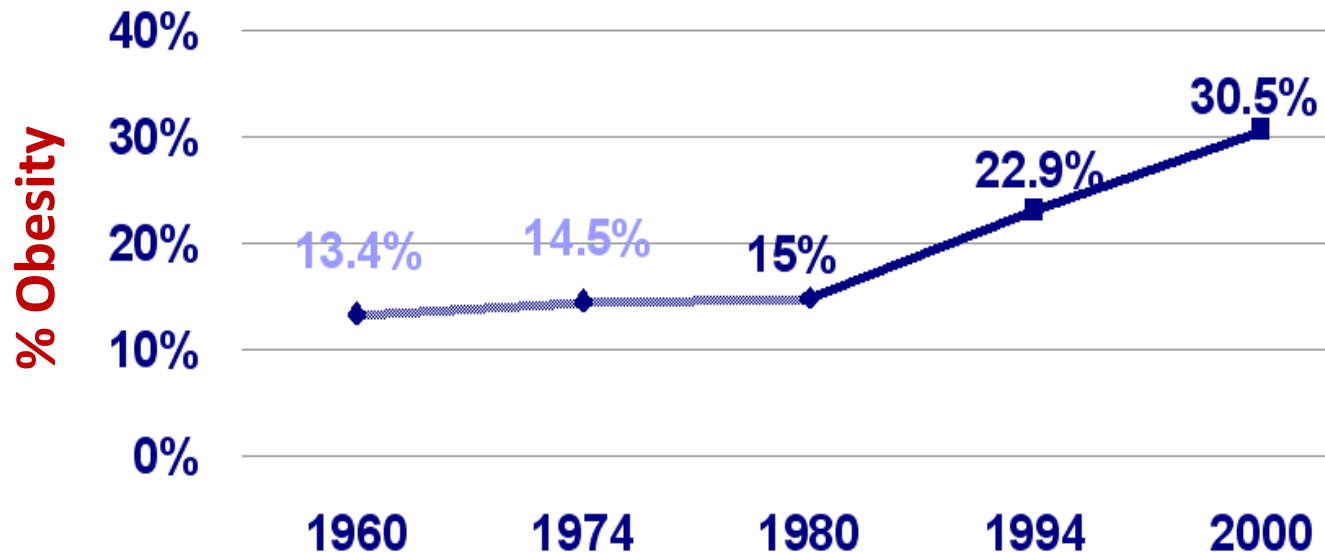
Risk Factors of OSA

3. Obesity

- Strongest risk factor for OSA.
- Present in >60% of patients referred for a diagnostic sleep evaluation.



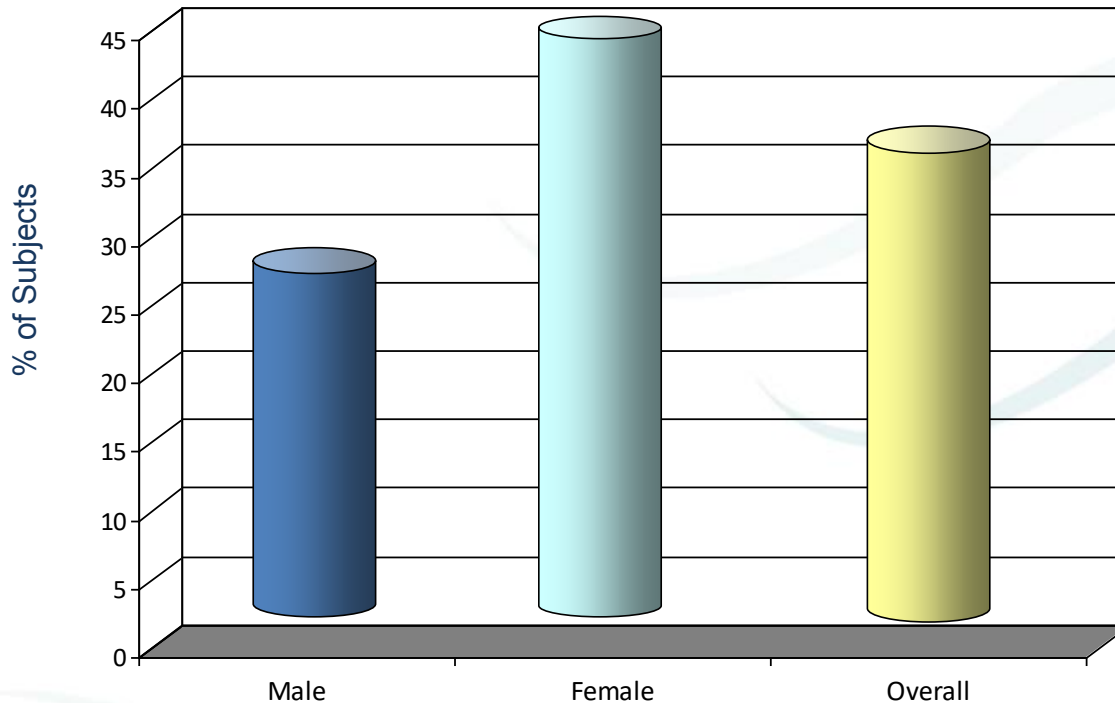
Twenty Years of Increasing Obesity



Source NCHS -- JAMA 2002;14:1723-27.

PREVALENCE OF OBESITY IN SAUDI ARABIA

المركز الجامعي
لطب وأبحاث النوم
UNIVERSITY SLEEP
DISORDERS CENTER



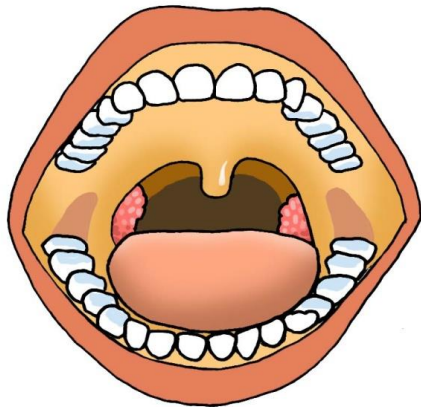
(BMI \geq 30 kg/m²)



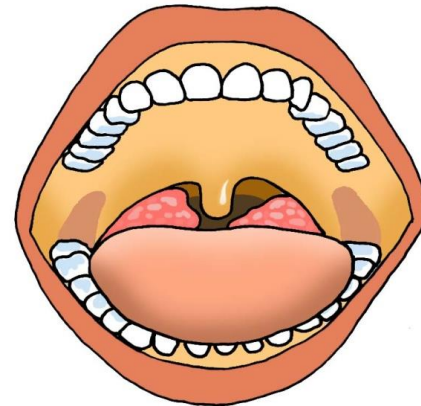
Patient Evaluation

Examine airway + screen BP “>60% of OSA have overt HTN by the time they present to you”

Normal Airway

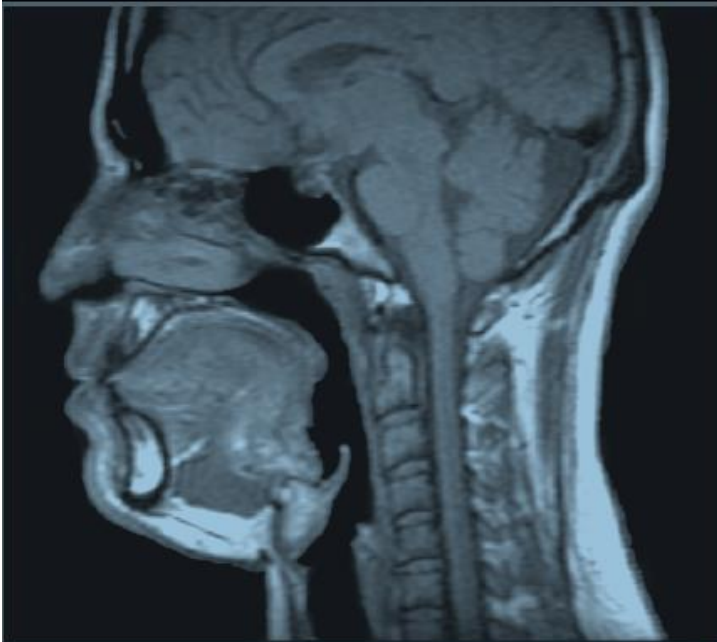


Obstructed Airway

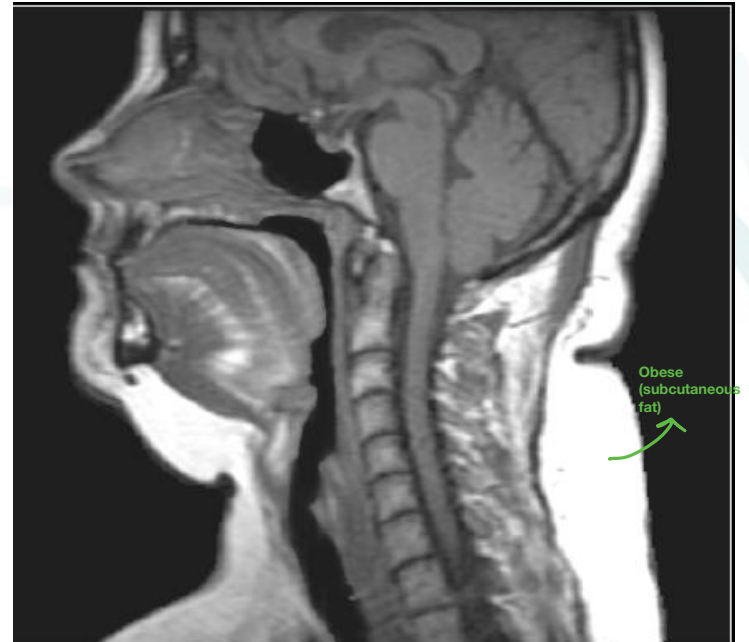


Sagittal Upper Airway MRI Images

Normal

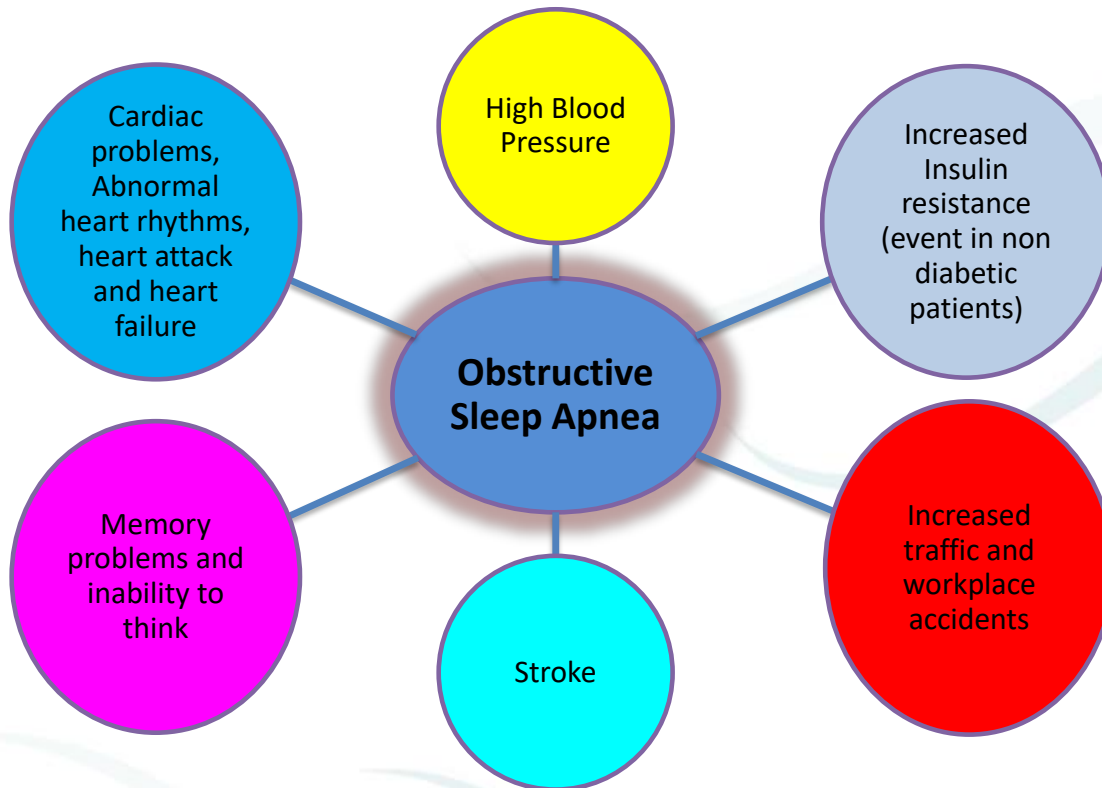


Apneic



OSA and Medical Comorbidity

Also depression, impotence.





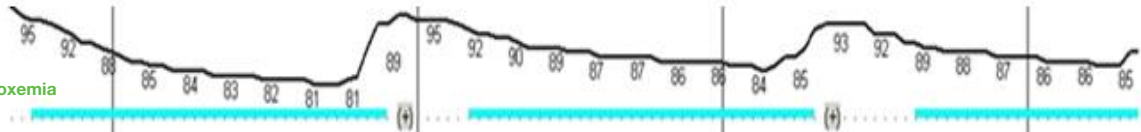
Representative Signals

OSA

No airflow but there's effort.

Oximetry

Desaturation/ intermittent hypoxemia



Heart Rate

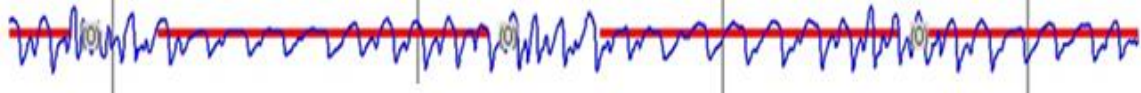


Nasal Airflow

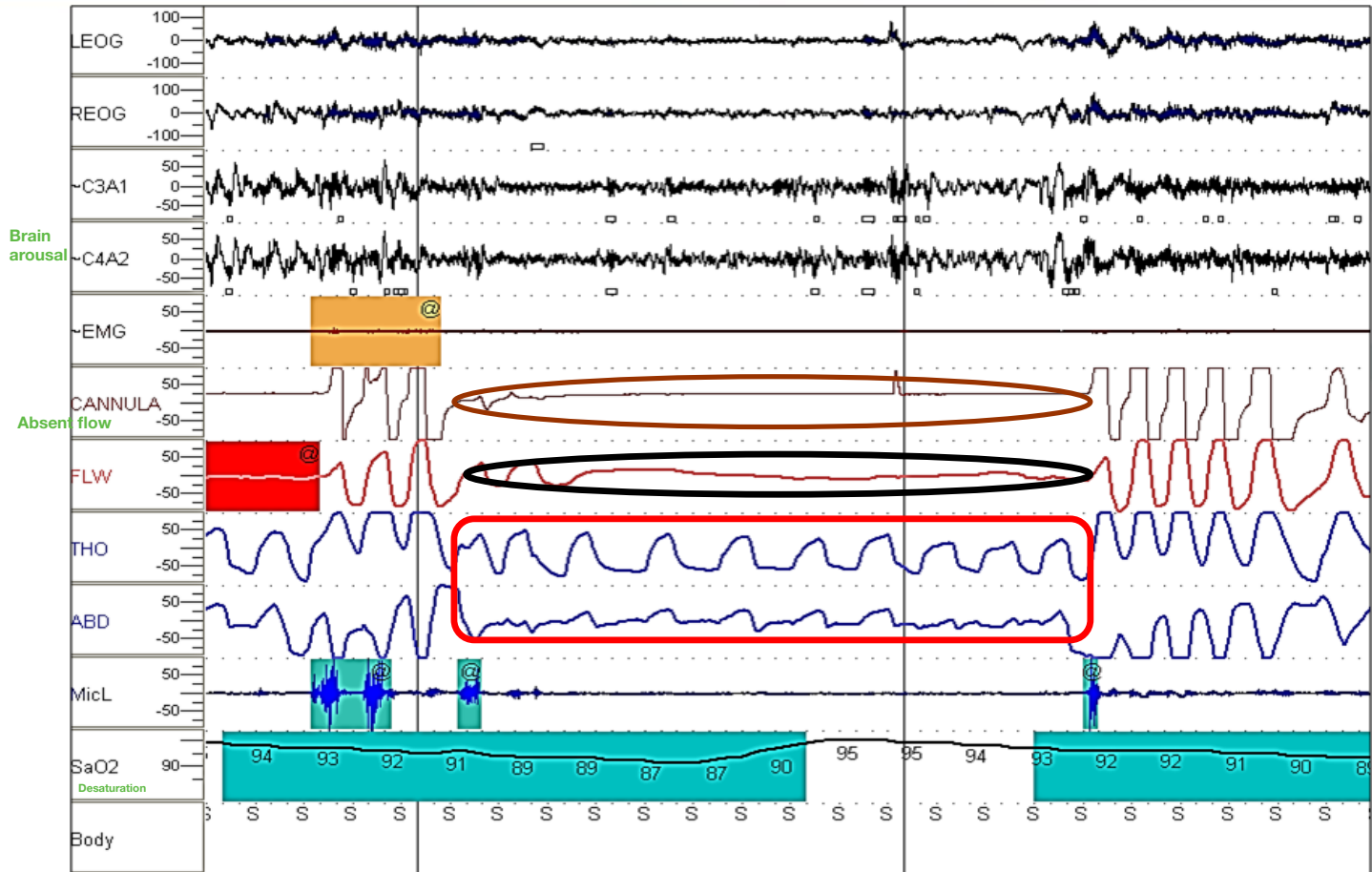
Repetitive Apnea, arousal, another apnea,...



Effort



Absent airflow but there is effort
Big snore (mic) during arousal and he started breathing, then apnea again



General Measures

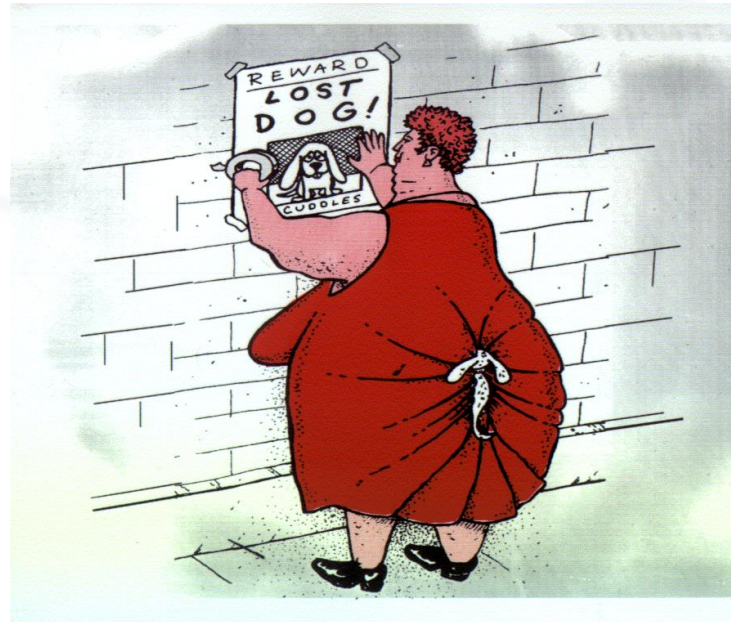
□ These measures should be tried in all patients with OSDB:

- Weight loss Even after bariatric surgery you must repeat sleep study cuz 60% will still have OSA. Cuz we said there's obesity and other causes (maxillofacial, genetic).
- Avoidance of alcohol & sedatives
- Sleep position
- Driving and operation of heavy machinery



Weight Loss

- Weight loss is like getting into heaven..... It is **SIMPLE** but it is not **EASY**.





Positional Therapy

- Try sleeping on the side.

عشان ما ينام على ظهره Tennis ball



Sleep Position Training





Specific Measures

- Continuous Positive Airway Pressure (CPAP)
Treatment of choice.
- Intra – Oral Appliances
- Surgical Treatment
- Hypoglossal Nerve Stimulation

Continuous Positive Airway Pressure (CPAP)

يمكن نسوي دراسة مقسومة أول الليل عشان نشخص واخر الليل نحطه على جهاز التنفس عشان نبرمجه حسب ما يناسبه
وممكن دراستين منفصلات وحدة للتشخيص وحدة لبرمجة الجهاز حسب نتائج تخطيط دراسة النوم
مممكن نرسله البيت ويستخدم Auto-CPAP لمدة ٣ أيام

Auto-CPAP is not as accurate as in-Lab CPAP. It detects breathing cessation (apnea) and starts raising the pressure to open the airway, then we prescribe him a programmed CPAP according to recorded numbers from the autoCPAP.

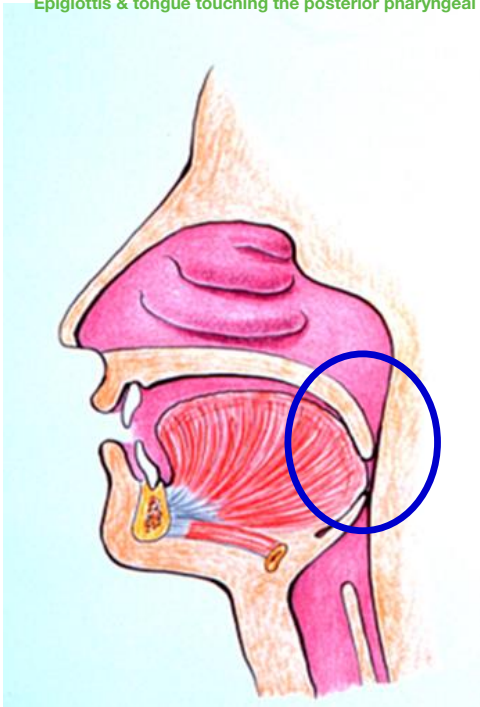
- Is the gold standard treatment



Continuous Positive Airway Pressure

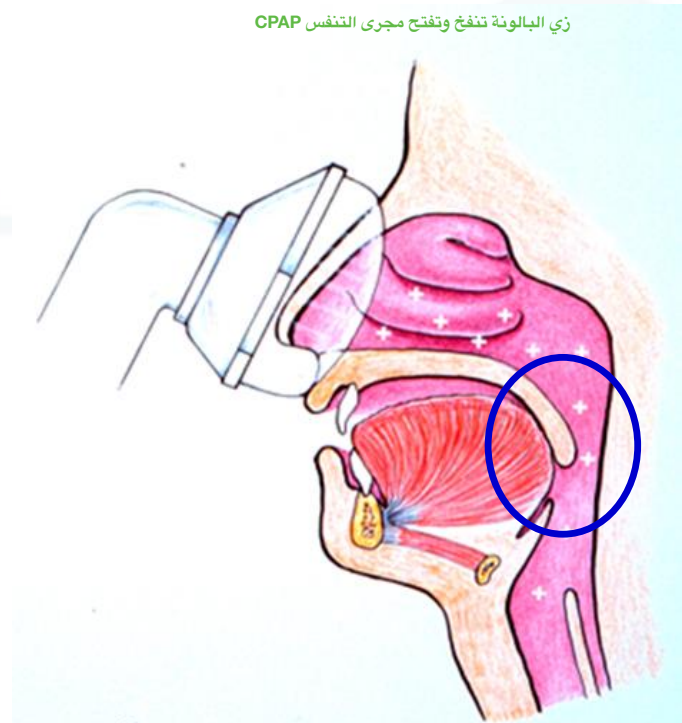
Before

Epiglottis & tongue touching the posterior pharyngeal wall



After

زي البالونة تنفخ وتفتح مجرى التنفس CPAP





○ Benefits of CPAP

- Improves quality of life even in mild OSA
- Improves bed partner sleep
- Improves daytime sleepiness
- Decreases motor vehicle accident
- Improves hypertension



○ Cont... (Benefits of CPAP)

- Increases ejection fraction in systolic CHF
- Improves insulin resistance
- Decreases inflammatory markers
 - CRP (C-reactive protein)

Abstract ▾

Send to: ▾

See 1 citation found by title matching your search:[Saudi Med J](#). 2015 Aug;36(8):911-9. doi: 10.15537/smj.2015.8.11716.**Long-term compliance with continuous positive airway pressure in Saudi patients with obstructive sleep apnea. A prospective cohort study.**[BaHammam AS¹](#), [Alasiri SS](#), [Al-Adab AH](#), [Alsadhan IM](#), [Altheyab AM](#), [Alrayes AH](#), [Alkhwajah MM](#), [Olaish AH](#).**⊕ Author information****Abstract**

OBJECTIVES: To evaluate continuous positive airway pressure (CPAP) compliance and define predictors of CPAP compliance among Saudi patients with obstructive sleep apnea (OSA) after applying an educational program.

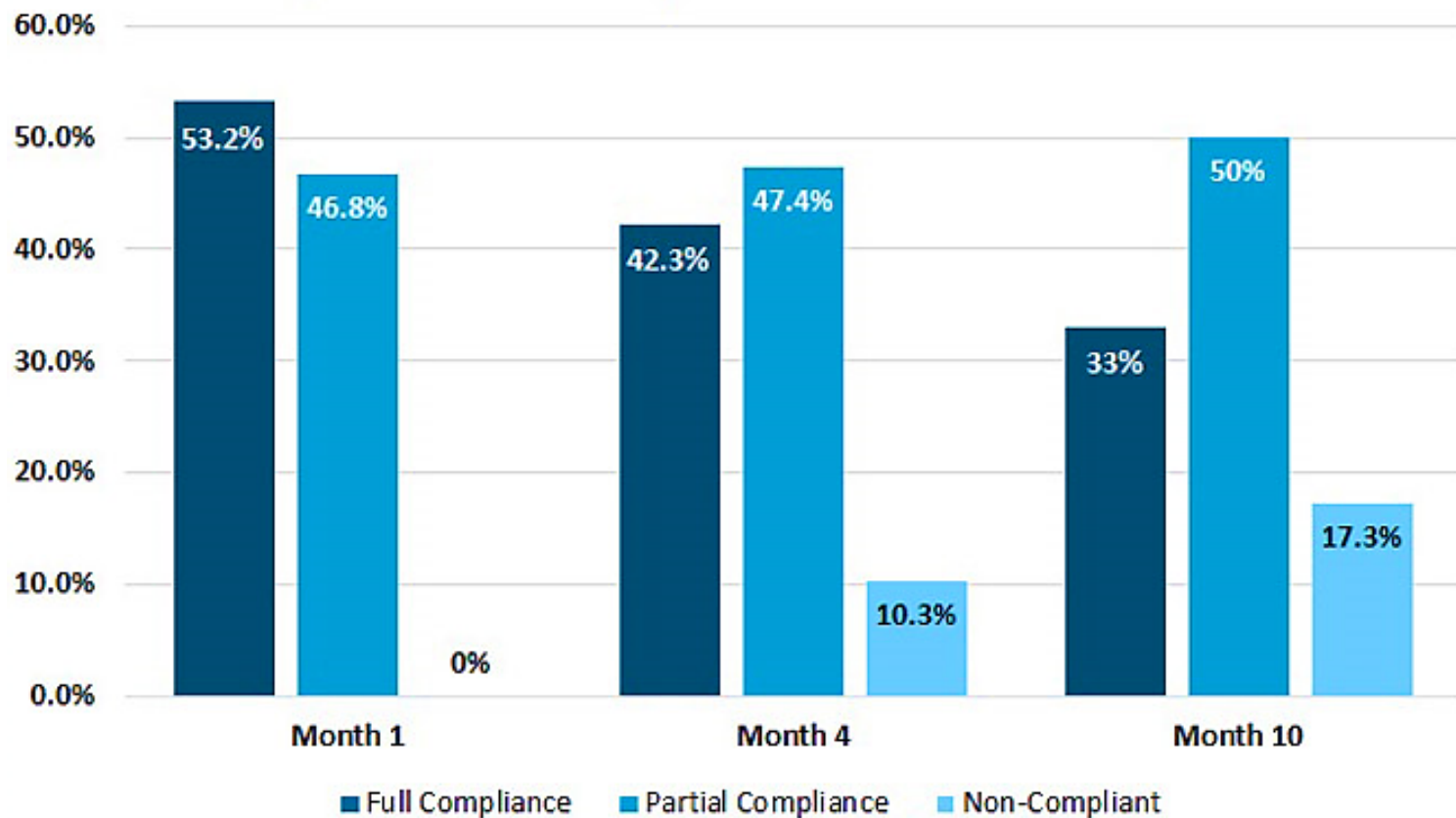
METHODS: This prospective cohort study included consecutive patients diagnosed to have OSA based on polysomnography between January 2012 and January 2014 in King Saud University, Riyadh, Kingdom of Saudi Arabia. All patients had educational sessions on OSA and CPAP therapy before sleep study, and formal hands-on training on CPAP machines on day one, day 7, and day 14 after diagnosis. The follow-up in the clinic was carried out at one, 4, and 10 months after initiating CPAP therapy. Continuous positive airway pressure compliance was assessed objectively. Logistic regression model was used to assess the predictors of CPAP adherence.

RESULTS: The study comprised 156 patients with a mean age of 51.9±12.1 years, body mass index of 38.4±10.6 kg/m², and apnea hypopnea index of 63.7±39.3 events/hour. All patients were using CPAP at month one, 89.7% at month 4, and 83% at month 10. The persistence of CPAP-related side effects and comorbid bronchial asthma remained as independent predictors of CPAP compliance at the end of the study.

CONCLUSION: With intensive education, support, and close monitoring, more than 80% of Saudi patients with OSA continued to use CPAP after 10 months of initiating CPAP therapy.

PMID: 26219440 [PubMed - in process] PMID: PMC4549586 **Free PMC Article**

Figure 1-A: CPAP compliance at 1, 4 and 10 months





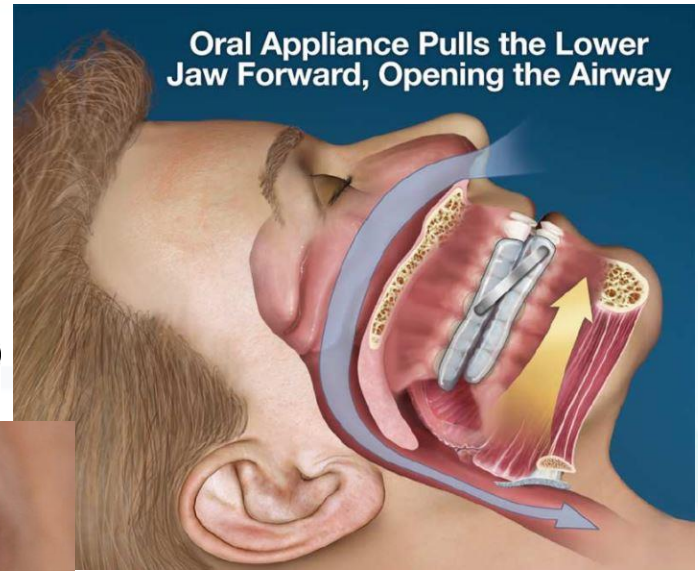
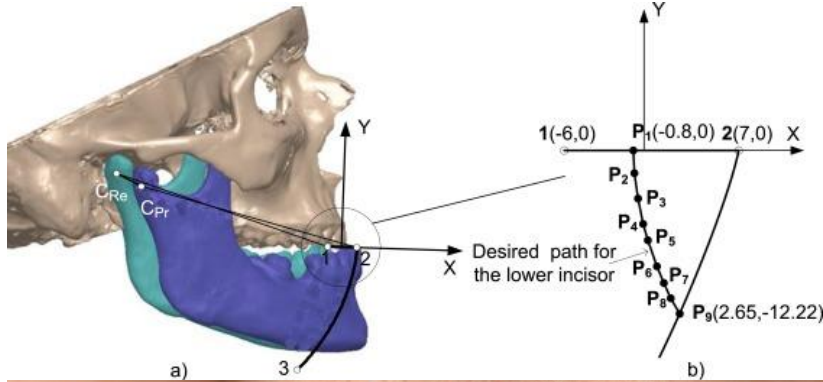
Conclusions

- 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

(Important)



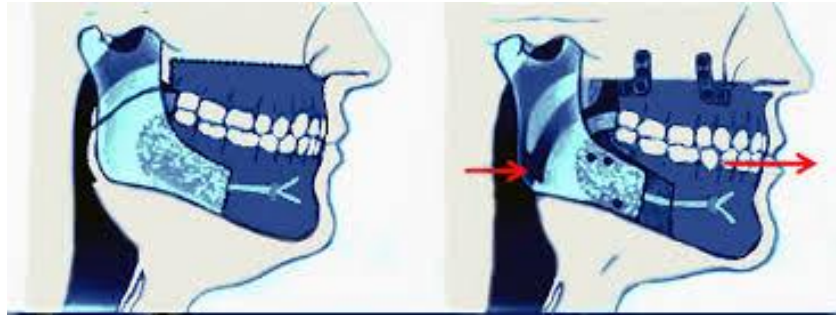
Mandibular Advancement Device



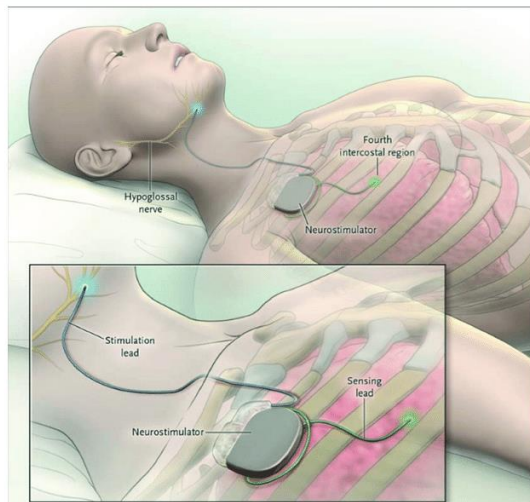


Maxillomandibular advancement

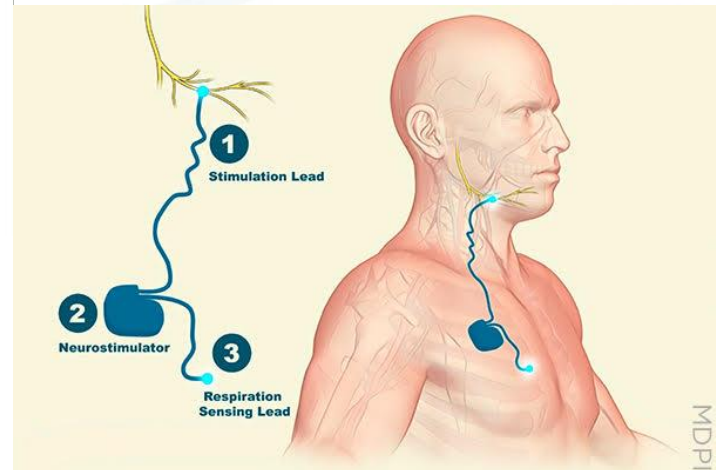
Maxilla & mandible pulled forward > tongue pulled with them > airway open. FDA approved surgery



Hypoglossal nerve stimulation



Implanted electrode when it senses breathing movement of intercostal muscles it stimulates hypoglossal nerve > genioglossus muscle contracts and moves forward > airway opened.
طوال ما هو نائم كل ما تنفس يطلع لسانه برا
Long term side effect: Tongue Pain



B.) Obesity Hypoventilation Syndrome

- Is defined by extreme obesity and alveolar hypoventilation during wakefulness.
 - Obesity
 - $\text{PaCO}_2 > 45$
 - $\text{PaO}_2 < 70$
 - Absence of significant pulmonary disease



○ Criteria A-C must be met

- A. Presence of hypoventilation during wakefulness ($\text{PaCO}_2 > 45 \text{ mm Hg}$) as measured by arterial PCO_2 , end-tidal PCO_2 , or transcutaneous PCO_2 .**
- B. Presence of obesity ($\text{BMI} > 30 \text{ kg/m}^2$; $> 95\text{th}$ percentile for age and sex for children).**
- C. Hypoventilation is not primarily due to**
 - **lung diseases,** Daytime hypercapnia With Absence of other causes of hypoercapnia like COPD, kyphoscoliosis, neuromuscular diseases; myasthenia gravis
 - **medication use,**
 - **neurologic disorder,**
 - **muscle weakness,**
 - **or a known congenital or idiopathic central alveolar hypoventilation syndrome.**



Clinical Features of OHS

1. Extreme Obesity





Clinical Features of OHS

OSA: more in men
OHS: more in women

Common scenario: 60yo lady, non-smoker, in ER with high bicarb & high PCO₂, having hypercapnic respiratory failure, on non-invasive ventilation. Her pulmonary function test is obstructive. Misdiagnosed as COPD. This is obesity hyperventilation syndrome.

2. Middle-aged

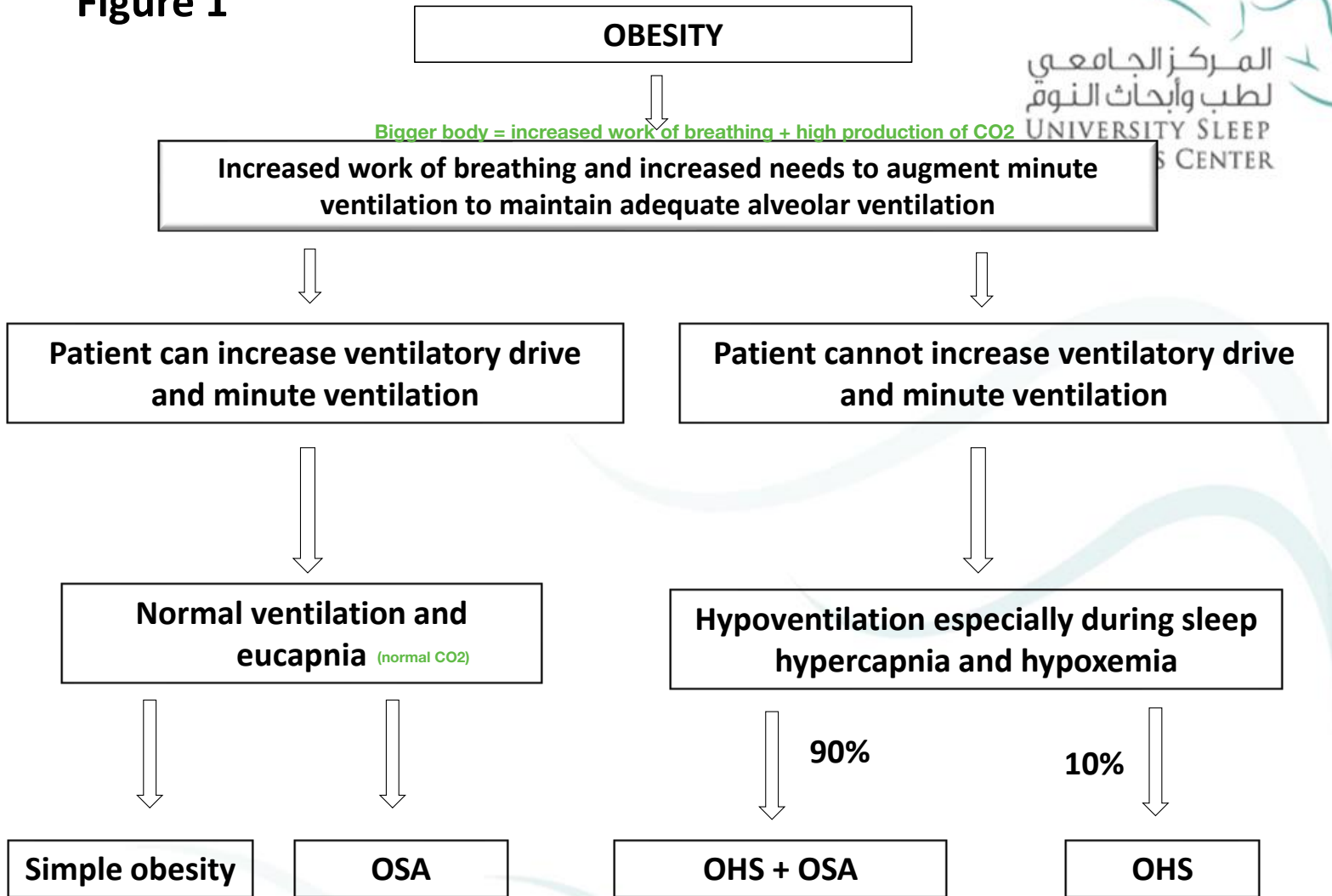
3. Significant sleep-disordered breathing (fatigue, hypersomnolence, snoring, morning headache)

90% OHS have coexisting OSA.
Severe hypersomnolence > OSA
Morning headache resulting from hypercapnia high PCO₂ accumulated during sleep.

4. Prone to develop severe pulmonary hypertension

By the time of presentation
70% pul htn
70% LV diastolic dysfunction

Figure 1



Saudi Med J. 2015; 36(2): 181–189.

PMCID: PMC4375695

doi: [10.15537/smj.2015.2.9991](https://doi.org/10.15537/smj.2015.2.9991)

Prevalence, clinical characteristics, and predictors of obesity hypoventilation syndrome in a large sample of Saudi patients with obstructive sleep apnea

[Ahmed S. BaHammam](#), FRCP, FCCP

○ Prevalence of OHS

- Out of 1693 OSA patients, OHS was identified in 144 **(8.5%)** (**women 66.7%**).

Probably because obesity and hypothyroid are higher among women

Prevalence of OHS in OSA

| Authors | Number | Study Design | Country | Age | BMI | AHI | OHS % * |
|------------------------------------|--------|---------------|--------------|------|------|------|---------|
| Mokhlesi et al ²² | 359 | Prospective | USA | 48 | 43 | 62 | 20 |
| Laaban and Chailleux ¹⁸ | 1,141 | Retrospective | France | 56 | 34 | 55 | 11 |
| Verin et al ²¹ | 218 | Retrospective | France | 55 | 34 | 51 | 10 |
| Kessler et al ¹⁷ | 254 | Prospective | France | 54 | 33 | 76 | 13 |
| Resta et al ¹⁹ | 219 | Prospective | Italy | 51 | 40 | 42 | 17 |
| Glope et al ¹⁶ | 175 | Retrospective | Spain | N/A | 32 | 42 | 14 |
| Akashiba et al ¹⁴ | 611 | Retrospective | Japan | 48 | 29 | 52 | 9 |
| Trakada et al ²⁰ | 276 | Prospective | Greece | 54.7 | 34.7 | 33.6 | 13.8 |
| Alzaabi et al ¹⁵ | 107 | Retrospective | UAE | 45.6 | 33.8 | 48.4 | 16.8 |
| BaHammam | 1693 | Prospective | Saudi Arabia | 46.2 | 35.7 | 41.9 | 8.9 |



BaHammam AS. SMJ 2015; 36(2):181-9

* 10-20% of OSA also have OHS

OHS has more dangerous complications and higher mortality (cor pulmonale, LV diastolic dysfunction, HF, ascites, LL edema, DM, HTN)

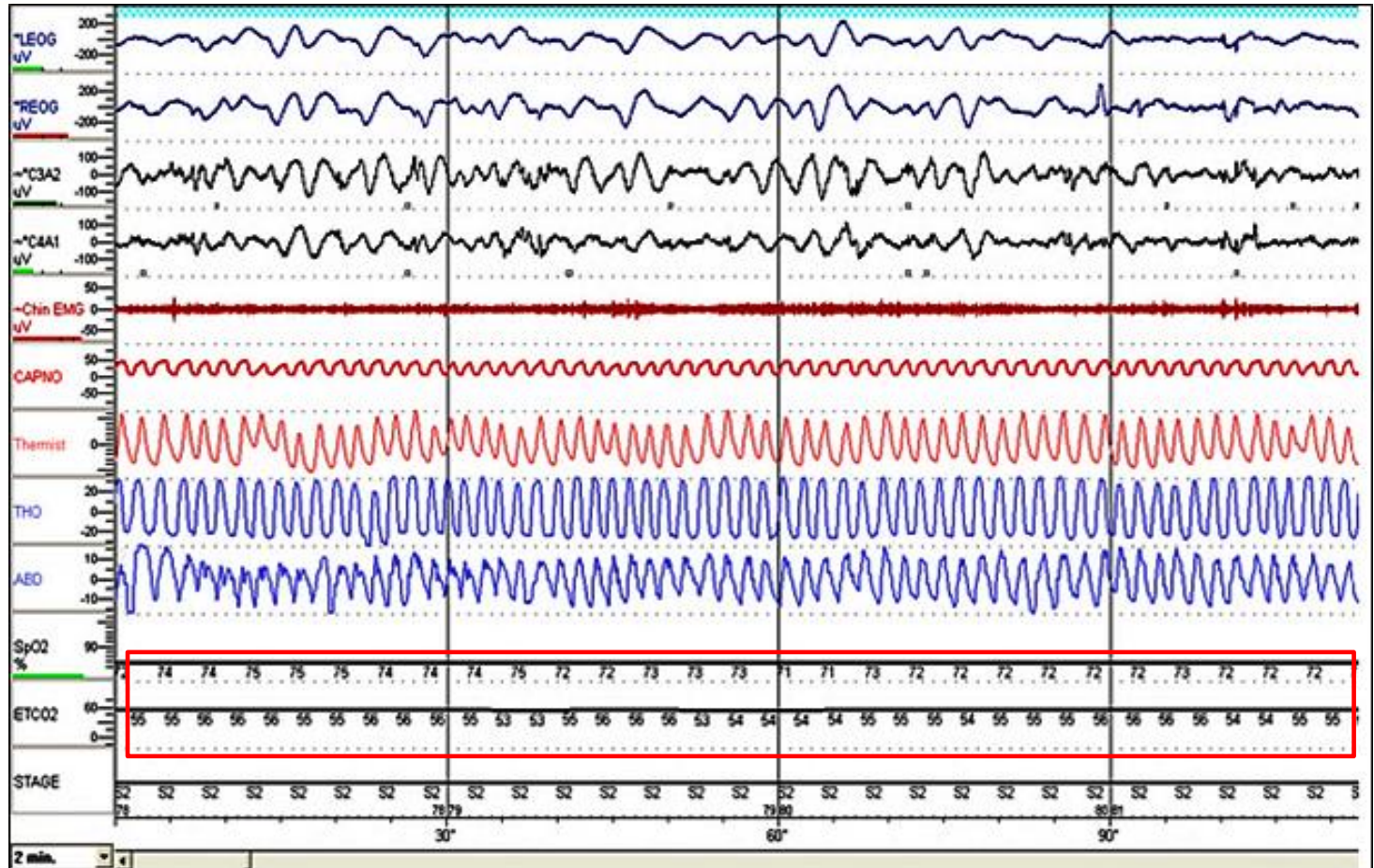
Prevalence of OHS in OSA

| Authors | Number | Study Design | Country | Age | BMI | AHI | OHS % |
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Patient with OHS

Sustained hypoxemia Oxygen saturation is at 70s and they have hypercapnia $PCO_2 \sim 56$. There is breathing but they are **HYPOVENTILATING** = OHS



C.) Central Sleep Apnea

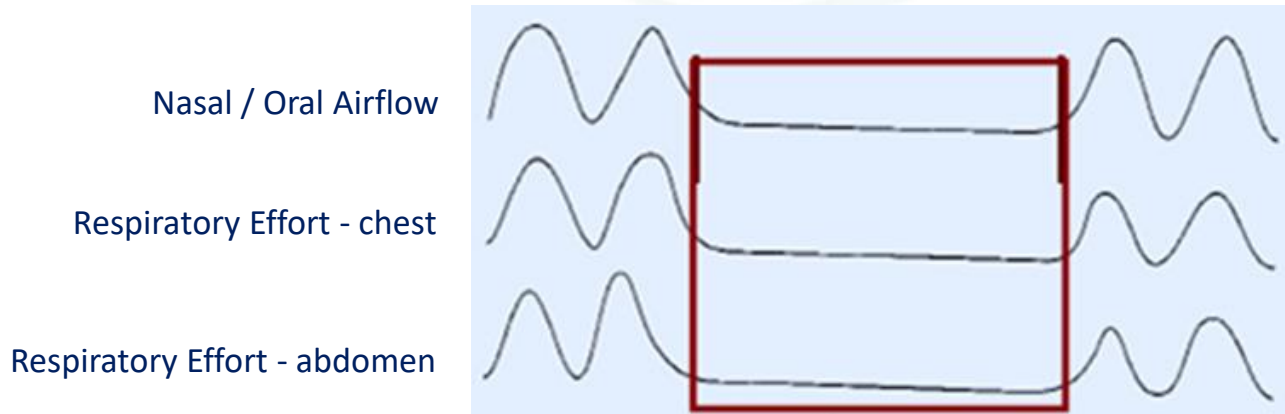
- Is a disorder of decreased breathing rate or depth, particularly during sleep due to a transient reduction or withdrawal of central output to the respiratory muscles (the diaphragm and intercostal muscles).

Mostly in children, stroke pts



Central Apnea

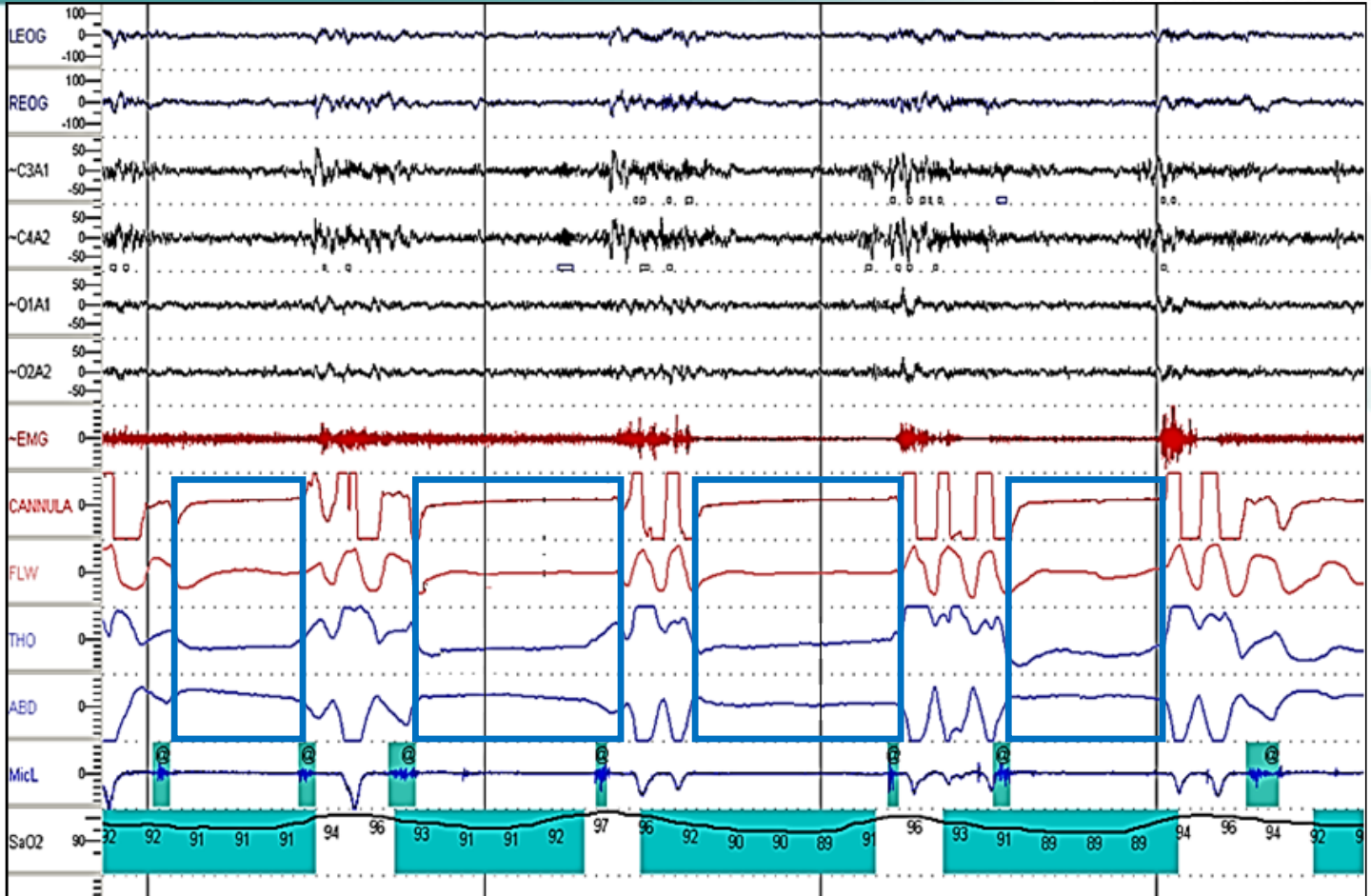
- Absent inspiratory effort throughout the entire period of absent airflow.





Central Apnea

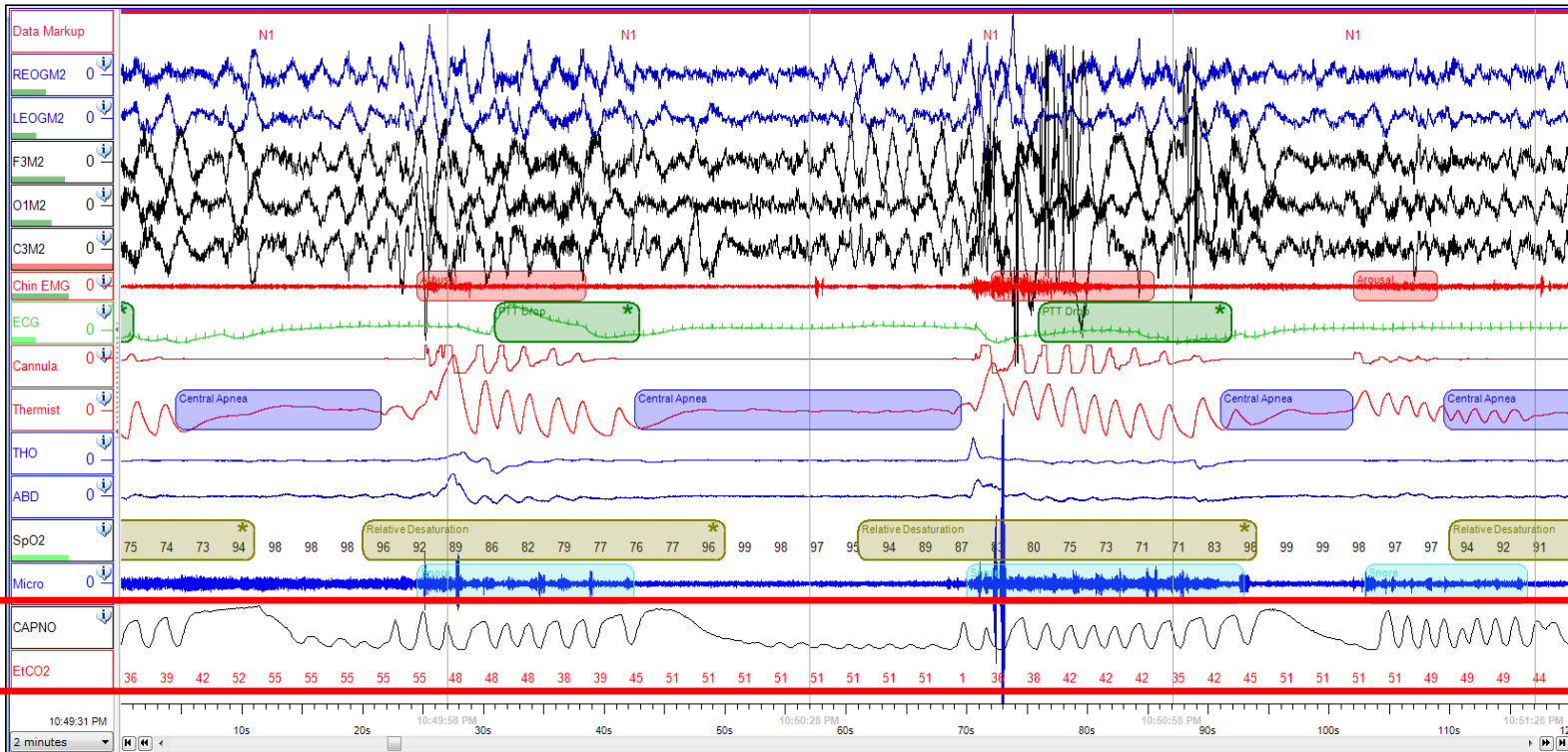
No effort and No flow





Central Apnea

Chyene strokes respiration
No flow + No effort





Cheyne Stokes Respiration

Criteria Not important

Diagnostic Criteria

(A or B) + C + D satisfy the criteria

A. The presence of one or more of symptoms

B. The presence of CSR is more common in men, THIN, AFib, HF.

- atrial fibrillation/flutter,
- congestive heart failure,
- **or** a neurological disorder.

○ Diagnostic Criteria

C. PSG shows all of the following:

1. **≥ 5 central apneas and/or central hypopneas per hour of sleep.**
2. **The total number of central apneas and/or central hypopneas is $> 50\%$ of the total number of apneas and hypopneas.**
3. **The pattern of ventilation meets criteria for Cheyne-Stokes breathing (CSB).**

Cheyne Stokes Respiration (Periodic Breathing)

- 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. **mortality HF with CSR > without CSR.**



Representative Signal

Periodic recurrent central apnea alternating with a crescendo-decrescendo pattern of tidal volume.
التنفس يزيد وينقص
بعدين تجي apnea

CSA - CSR

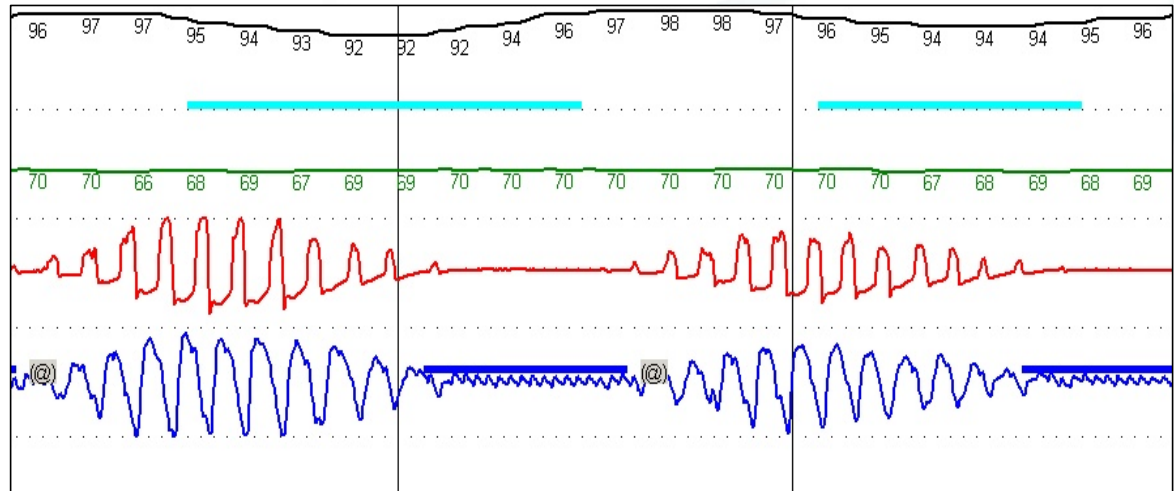
CSR Arousal happens at the peak of apnea. Unlike OSA arousal at the end of apnea.
CSR have insomnia cuz it occurs during transition from wakefulness to stage 1 sleep.

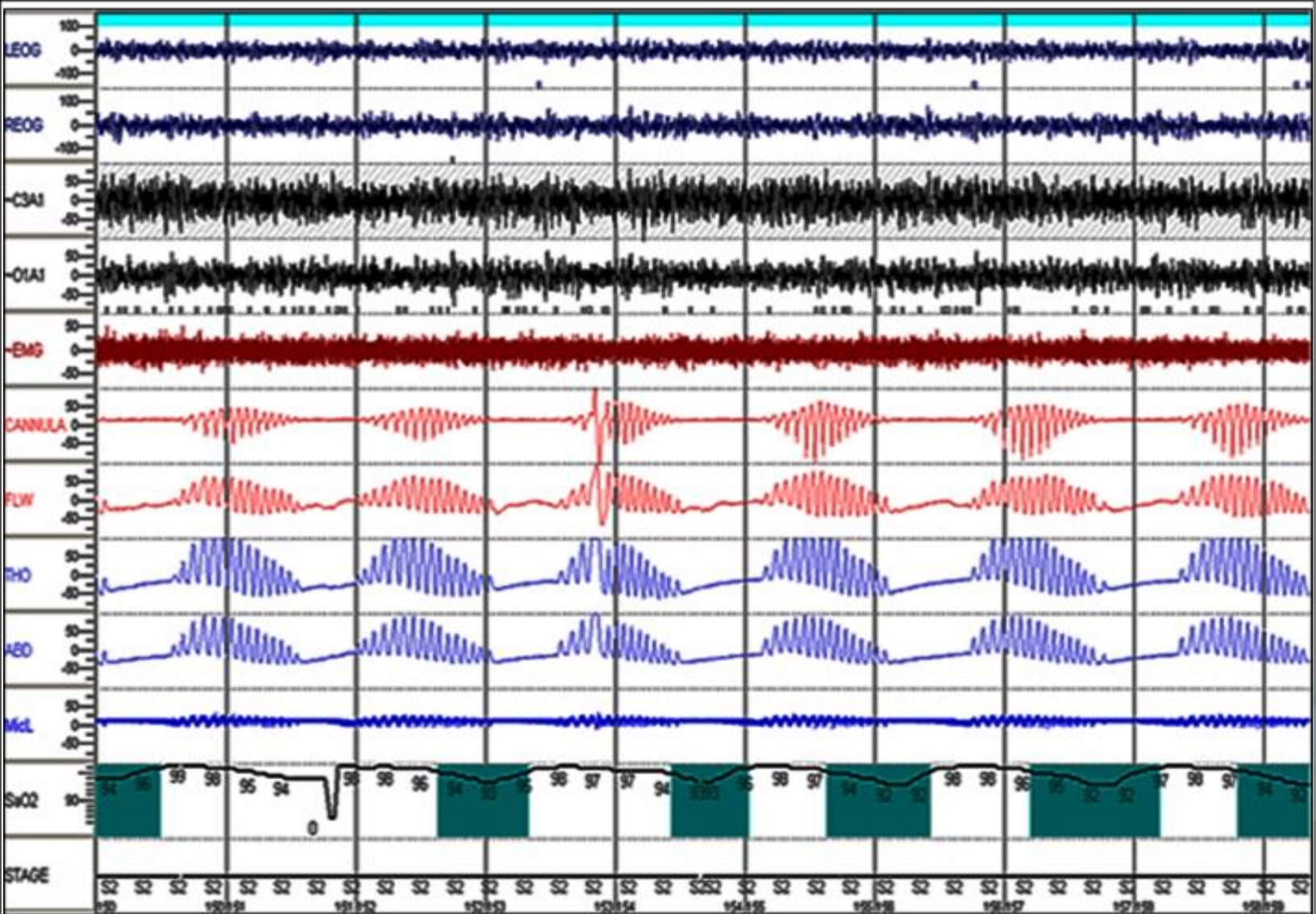
Oximetry

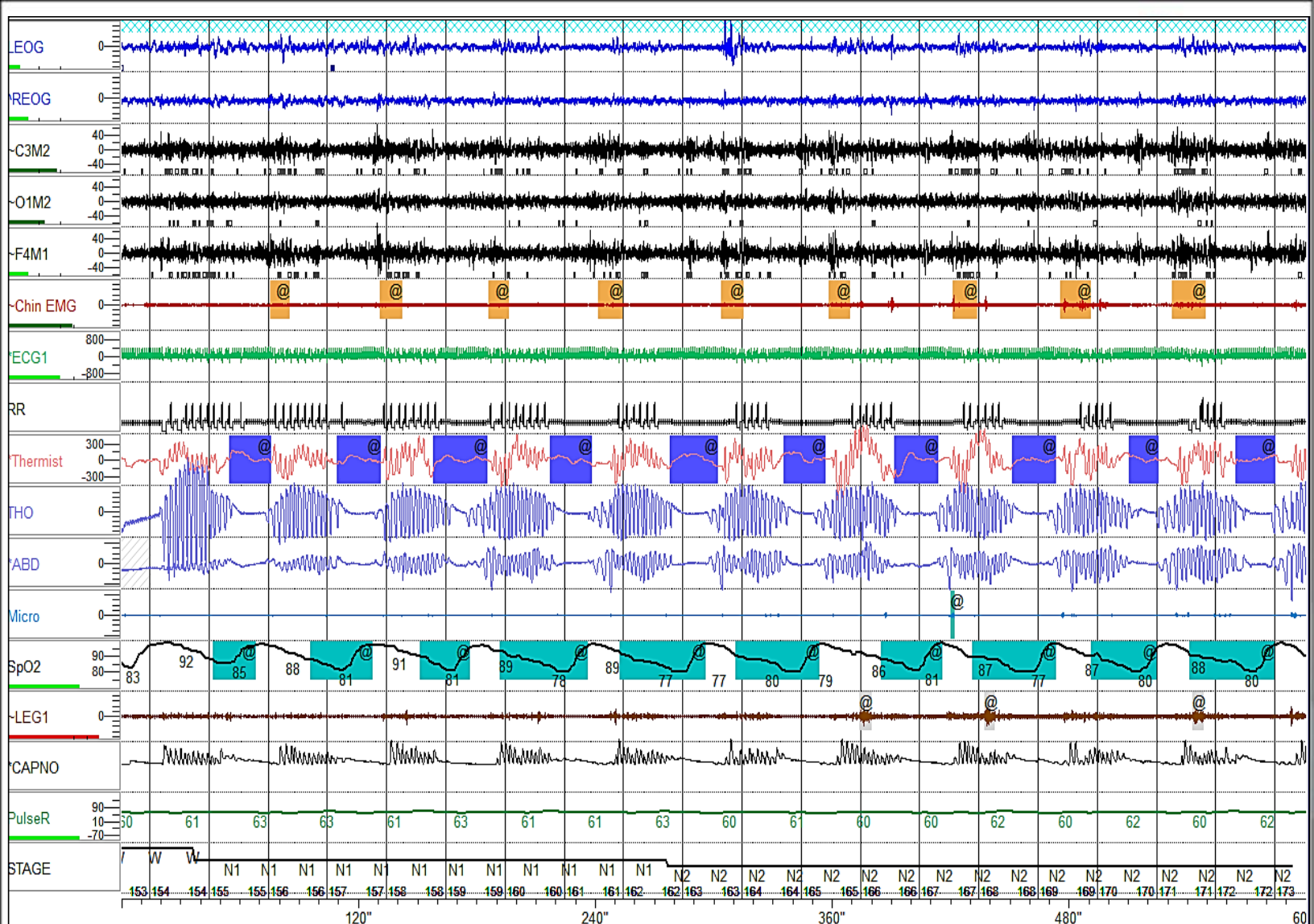
Heart Rate

Nasal Airflow

Effort









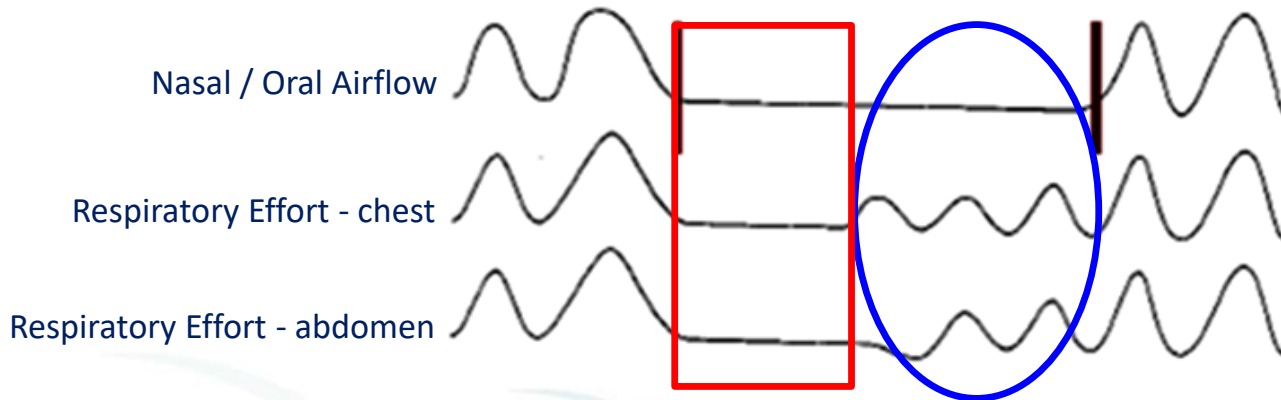
D.) Mixed Apnea

- Begins as central apnea followed by obstructive apnea
- Seen in patients with OSA Managed as OSA.
- Often found in Down's Syndrome



Mixed Apnea

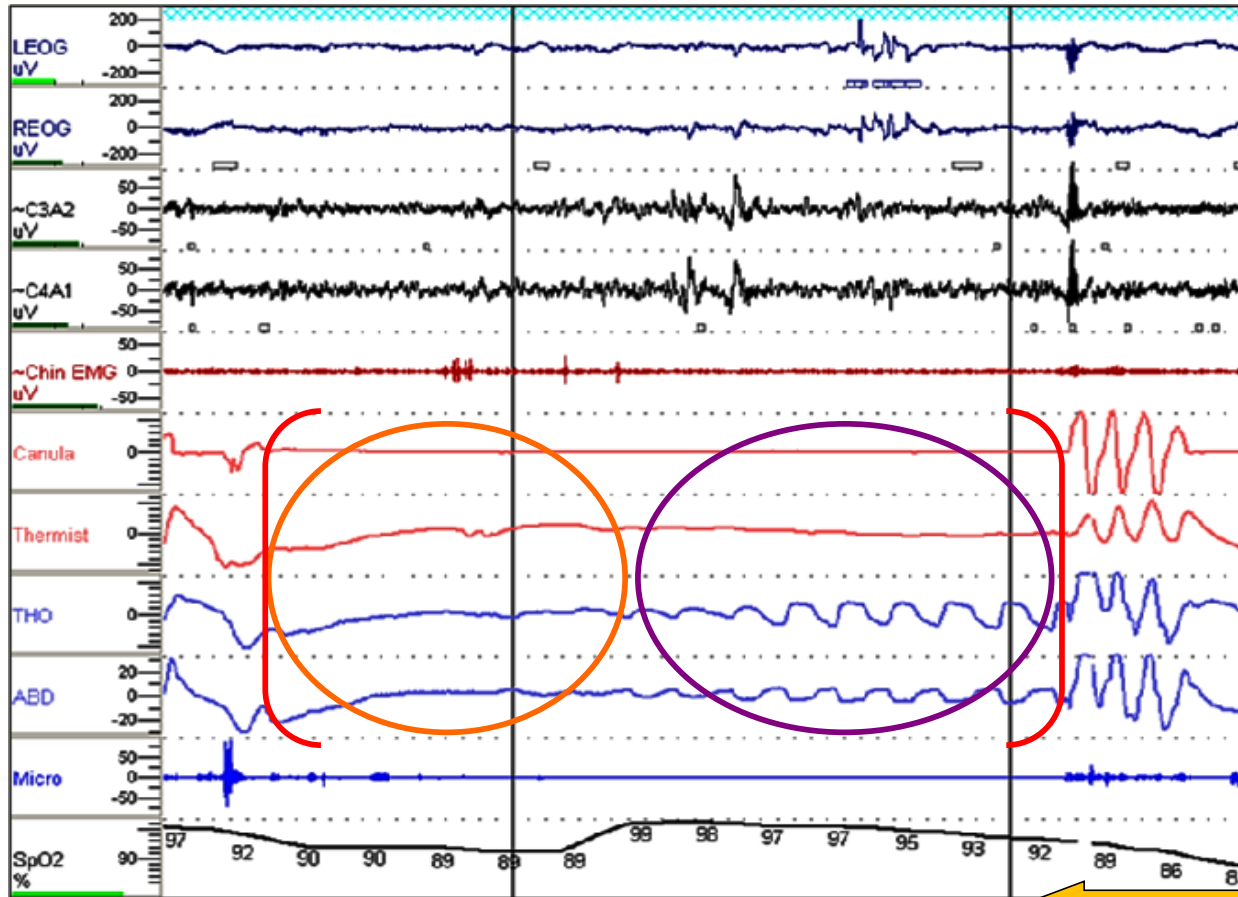
- Absent inspiratory effort in the initial portion of the event, followed by resumption of inspiratory effort in the second portion of the event.





Mixed Apnea

Starts central "no flow and no effort"
then obstructive "effort with obstructed airway"





Key Points

- Sleep Disordered Breathing is an important medical disorder that warrants active investigation by means of a clinical evaluation and polysomnographic sleep studies.
*It's not just a matter of not sleeping well
It's associated with many diseases Cardiovascular, neurological, psychiatric, sexual.*
- Treatment is essential, not only to improve the symptoms that include sleepiness, but also to prevent the development of cardiovascular complications.
Main treatment is positive airway pressure, others are:
- Effective treatments exist that include behavioral, medical and surgical means; dramatic improvements in patient's well being can be achieved.

Question:

- 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)

answer: C



Thank You