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 grasping/choking/cyanosis).
  - Define the polygraphic patterns associated with obstructive sleep disordered breathing.
  - Describe the major treatments used for OSA.
Central Sleep Apnea

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


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.

Between the lines and the chart represents four pages of the study 8-7 complete hours totaling 03 seconds per page, totaling four pages.
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
All of 3 there’s NO airflow = Apnea

<table>
<thead>
<tr>
<th>Flow</th>
<th>Obstructive</th>
<th>Mixed</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Graph]</td>
<td>[Graph]</td>
<td>[Graph]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effort</th>
<th>Obstructive</th>
<th>Mixed</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Graph]</td>
<td>[Graph]</td>
<td>[Graph]</td>
</tr>
</tbody>
</table>

- All three conditions result in no airflow, indicating Apnea.
- Obstructive: Flow stops due to obstruction, Effort present but airflow still absent.
- Mixed: Flow stops due to obstruction, Effort present but airflow still absent.
- Central: Flow stops due to central nervous system cause, Effort present but airflow still absent.

- There is effort but airway closed no airflow.
- 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

(ICSD), 3rd ed. 2014
A.) What is OSA?

B. Polysomnography (PSG) or OCST\(^1\) 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).

\(\text{AHI} = \frac{\text{Episodes of apnea and hypopnea}}{\text{hours of sleep}}\)

If \(\text{AHI} \geq 5\) but <15 we need the above symptoms to diagnose

\(^1\) ICSD, 3rd ed. 2014
A.) What is OSA?

C. PSG or OCST demonstrates:

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

(ICSD), 3rd ed. 2014
# OSA Severity Criteria

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

<table>
<thead>
<tr>
<th>Severity</th>
<th>AHI /hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Mild</td>
<td>5 - ≤15</td>
</tr>
<tr>
<td>Moderate</td>
<td>15 - 30</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>

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
Prevalence of Sleep Apnea

<table>
<thead>
<tr>
<th>Young</th>
<th>4% Men</th>
<th>AHI &gt; 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2% Women</td>
<td>EDS</td>
</tr>
<tr>
<td>N = 802</td>
<td></td>
<td>Age 36-60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kripke</th>
<th>9% Men</th>
<th>AHI &gt; 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>5% Women</td>
<td>0₂ sat 4%</td>
</tr>
<tr>
<td>N = 355</td>
<td></td>
<td>Age 40-64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Olson</th>
<th>5% Men</th>
<th>AHI &gt; 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.2% Women</td>
<td>Age 35-69</td>
</tr>
<tr>
<td>N = 2,202</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bearpark</th>
<th>10% Men</th>
<th>AHI &gt; 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>7% Women</td>
<td>Age 40-85</td>
</tr>
<tr>
<td>N = 400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prevalence increases with Age.
OSA is a disease of middle aged adults 45-65.

غالباً
|                                | Middle-aged Saudi Men (n=578) | Middle-aged Saudi Women (n=400) | Netzer et al\(^1\) (n=744) M + F | Heistand et al\(^2\) (n=1506) M + F | Sharma et al\(^3\) (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.**

## Prevalence in a Saudi Sample

<table>
<thead>
<tr>
<th></th>
<th>Middle-aged Saudi Men (n=578)</th>
<th>Middle-aged Saudi Women (n=400)</th>
<th>Netzer et al(^1) (n=744) M + F</th>
<th>Heistand et al(^2) (n=1506) M + F</th>
<th>Sharma et al(^3) (n=180) 80% Males</th>
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### Prevalence of Sleep Apnea

<table>
<thead>
<tr>
<th>Study</th>
<th>Men: 11.2%</th>
<th>Women: 4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wali et al, Saudi Arabia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Otherwise snore and this will happen to you....

Or sleep alone....

www.corbett.com.au
2. **Daytime Sleepiness**

- Differential diagnosis includes:
  - Insufficient Sleep
  - Medical and psychological disorders
  - Medications
Clinical Features of OSA

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

Screening Daytime Sleepiness

The University Sleep Disorders Center
King Khalid University Hospital

Epworth Sleepiness Scale

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

Score ≥ 10 indicates daytime sleepiness in the past month.
**Screening Daytime Sleepiness**

**Epworth Sleepiness Scale**

<table>
<thead>
<tr>
<th>فرض إن تقف أو تنام</th>
<th>الحالات للقراءة</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>مشاهدة التلفزيون</td>
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<tr>
<td>2</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>الجلوس بمكان عمل شئ (في صالة انتظار أو في اجتماع)</td>
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<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>الاستراحة بعد الظهر (عندما تسمح الظروف)</td>
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<thead>
<tr>
<th>الحالات للقراءة</th>
<th>الحالات للقراءة</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>خلاف الجلوس والمحادثة مع شخص ما</td>
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</tbody>
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<table>
<thead>
<tr>
<th>الحالات للقراءة</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>الاستراحة بعد الغداء</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>الحالات للقراءة</th>
<th>الحالات للقراءة</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>صفر</td>
</tr>
<tr>
<td>2</td>
<td>في السفارة عند التوقف لبضع دقائق خلال رحلة السير</td>
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</table>

<table>
<thead>
<tr>
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<th>الحالات للقراءة</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>صفر</td>
</tr>
</tbody>
</table>

**منذ متى يحدث لك ذلك؟ ( أشهر/ سنوات) **
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.

# STOP Bang Questionnaire

**Personal Profile**

<table>
<thead>
<tr>
<th>No.:</th>
<th>PSG S No:</th>
<th>Nationality:</th>
<th>□ Saudi</th>
<th>□ Non Saudi</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Age (Years):</th>
<th>Height (cm):</th>
<th>Weight (Kgs):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Neck Size (cm):</th>
<th>Occupation:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Marital Status:</th>
<th>□ Single</th>
<th>□ Married</th>
<th>□ Divorced</th>
<th>AHI:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Hospital Name:</th>
<th>City:</th>
</tr>
</thead>
</table>

Please answer the following questions as accurately as possible. Where applicable, place a check mark (✓) next to the best answer:

<table>
<thead>
<tr>
<th><strong>S</strong>noring?</th>
<th>Do you Snore Loudly (louder than talking or loud enough to be heard through closed doors)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>T</strong>ired?</th>
<th>Do you often feel Tired, Fatigued, or Sleepy during the daytime?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>O</strong>bserved?</th>
<th>Has anyone observed you Stop Breathing during your sleep?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>P</strong>ressure?</th>
<th>Do you have or are being treated for High Blood Pressure?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>B</strong>ody <strong>M</strong>ass <strong>I</strong>ndex</th>
<th>BMI is more than 35?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>A</strong>ge</th>
<th>Age older than 50?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>N</strong>eck <strong>s</strong>ize <strong>l</strong>arge?</th>
<th>Do you have a Neck that Measures more than 16 inches / 40 cm around (measure at Adam’s Apple)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>G</strong>ender</th>
<th>Male? Male = higher score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○ Yes</td>
</tr>
</tbody>
</table>

http://sleep.ksu.edu.sa

USDC Forms: STOPBang Questionnaire
المشكلات الشخصية

العمر:
الاسم الكامل:
الجنس:
البطن (كليوبول):
الطول (سم): 
الوزن (كيلو): 
الفولكلية (سم): 
ال------+-------

المصطلحات:

الرجاء الإجابة على الأسئلة أدناه:

1. هل تشعر بتحسس عالي (أعلى من صوت الناشر) أثناء النوم، أو أن شعورك به يسبب ضيقًا عندما تضع الأربطة على الأذن؟
2. هل تشعر بالدهق؟
3. هل تشعر بالدوار؟
4. هل تشعر بالآلام البطنية؟
5. هل تشعر بالآلام في الرأس؟
6. هل تشعر بالآلام في الظهر؟
7. هل تشعر بالآلام في الوريد؟
8. هل تشعر بالآلام في الأطراف؟
9. هل تشعر بالآلام في الرأس؟
10. هل تشعر بالآلام في الأطراف؟
11. هل تشعر بالآلام في الأطراف؟
12. هل تشعر بالآلام في الأطراف؟
13. هل تشعر بالآلام في الأطراف؟
14. هل تشعر بالآلام في الأطراف؟
15. هل تشعر بالآلام في الأطراف؟
16. هل تشعر بالآلام في الأطراف؟
17. هل تشعر بالآلام في الأطراف؟
18. هل تشعر بالآلام في الأطراف؟
19. هل تشعر بالآلام في الأطراف؟
20. هل تشعر بالآلام في الأطراف؟

http://sleep.ksu.edu.sa
USDC FORMS: STOPBang Questionnaire
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?
    _ a. Yes
    _ b. No
    _ c. Don’t know
استبيان برلين

اسم: _______________________
رقم الماك: __________________
الطول (الكلير): ______________
الوزن (الكلير): ______________
ذكر/أنثى: ___________________

السالم الأول:
1. هل تدخن؟
   - نعم
   - لا
2. هل تعانق?
   - نعم
   - لا
3. هل تعانق?
   - نعم
   - لا

السالم الثاني:
4. هل سبق أن سبب السحور الإرهاق لتقليل?
   - نعم
   - لا
5. هل فيه أشخاص كثيرون توقف التنفس أثناء النوم?
   - نعم
   - لا
6. كم مرة تشعر بالتهاب أو الإرهاق عند الاحتفاظ النوم؟
   - كل يوم
   - 2-3 مرات
   - 1-2 مرات
   - لا يحدث
7. هل تشعر بأد toddle أو الإرهاق أثناء ساعات الظهيرة؟
   - نعم
   - لا

1
8. هل سبق أن تعثت أثناء قيادة السيارة أو الانتظار (الطريق) ملأ؟
   □ نعم
   □ لا

إذا كانت الإجابة نعم:
9. كم مرة يحدث هذا؟
   □ كان يوما
   □ 3-4 مرات
   □ مرة واحدة
   □ مرة في مرة بالأسواد
   □ مرة في مرة بالأسود
   □ لا

الئمة الثالثة:
10. هل كنت مصاب بارتفاع ضغط الدم؟
   □ نعم
   □ لا
   □ لا أعرف
WHAT ARE THE RISK FACTORS?
1. **Structural Abnormalities:**

- Short Fat Neck
  
  (Neck circumference >17”/16”)
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

Retrognathia

Genioglossus muscle pushed backward
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.
   Hyperactive inattentive – ADHD misdiagnosis. In contrast to adults daytime samnolence.
   In children surgery is highly effective.

Sleep apnea and children
www.dcsmiles.com/services/sleep-apnea/sleep-and-children/
Cont..
(Upper airway narrowing)

- Long uvula
Large tongue with teeth marking on the tongue.

Non-Obstructed Airway

Obstructed Airway

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
3. Obesity

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

PREVALENCE OF OBESITY IN SAUDI ARABIA

% of Subjects

- Male
- Female
- Overall

(BMI ≥ 30 kg/m²)

Al-Nozha et al. SMJ 2005;26:824-829
Patient Evaluation

Normal Airway

Obstructed Airway

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

Sleep Disorders & Sleep Apnea with Dr. Kushner, DDS
http://www.brownkushner.com/Sleep Apnea.pdf
Sagittal Upper Airway MRI Images

Normal

Apneic

(Schwab et al, Am J Respir Crit Care Med 152:1673, 1995)
OSA and Medical Comorbidity

- Obstructive Sleep Apnea
  - Cardiac problems, Abnormal heart rhythms, heart attack and heart failure
  - Increased insulin resistance (event in non diabetic patients)
  - Increased traffic and workplace accidents
  - Stroke
  - Memory problems and inability to think

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
  - Avoidance of alcohol & sedatives
  - Sleep position
  - Driving and operation of heavy machinery

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).
Weight Loss

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

- Try sleeping on the side.
Sleep Position Training
Specific Measures

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

• Is the gold standard treatment

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.
Continuous Positive Airway Pressure

Before
Epiglottis & tongue touching the posterior pharyngeal wall

After
CPAP
زي البالونة تنفخ وتفتح مجرى التنفس
Benefits of CPAP

• Improves quality of life even in mild OSA
• Improves bed partner sleep
• Improves daytime sleepiness
• Decreases motor vehicle accident
• Improves hypertension
• Increases ejection fraction in systolic CHF
• Improves insulin resistance
• Decreases inflammatory markers
  • CRP (C-reactive protein)
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.
Figure 1-A: CPAP compliance at 1, 4 and 10 months

- Month 1: 53.2% Full Compliance, 46.8% Partial Compliance, 0% Non-Compliant
- Month 4: 42.3% Full Compliance, 47.4% Partial Compliance, 10.3% Non-Compliant
- Month 10: 33% Full Compliance, 50% Partial Compliance, 17.3% Non-Compliant
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
Mandibular Advancement Device

Oral Appliance Pulls the Lower Jaw Forward, Opening the Airway
Maxillomandibular advancement

Maxilla & mandible pulled forward > tongue pulled with them > airway open. FDA approved surgery.
Implanted electrode when it senses breathing movement of intercostal muscles it stimulates hypoglossal nerve > genioglossus muscle contracts and moves forward > airway opened.

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,
- medication use,
- neurologic disorder,
- muscle weakness,
- or a known congenital or idiopathic central alveolar hypoventilation syndrome.

Daytime hypercapnia With Absence of other causes of hypoventilation like COPD, kyphoscoliosis, neuromuscular diseases; myasthenia gravis

(ICSD), 3rd ed. 2014
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

OSH: more in women

OSA: more in men

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.

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

By the time of presentation
70% pul htn
70% LV diastolic dysfunction
Increased work of breathing and increased needs to augment minute ventilation to maintain adequate alveolar ventilation

Patient can increase ventilatory drive and minute ventilation

Normal ventilation and eucapnia (normal CO2)

Simple obesity

OSA

Patient cannot increase ventilatory drive and minute ventilation

Hypoventilation especially during sleep hypercapnia and hypoxemia

OHS + OSA

OHS

Bigger body = increased work of breathing + high production of CO2

Genetic factors play in this variation

AlDabal & BaHammam. ATM 2010
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
• Out of 1693 OSA patients, OHS was identified in 144 (8.5%) (women 66.7%).

Probably because obesity and hypothyroid are higher among women

Saudi Med J 2015; Vol. 36 (2)
## Prevalence of OHS in OSA

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*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)
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*BaHammam AS. SMJ 2015; 36(2):181-9*
Patient with OHS

Sustained hypoxemia Oxygen saturation is at 70s and they have hypercapnia PCO2 ~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 atrial fibrillation/flutter,
   congestive heart failure,
   or a neurological disorder.

CSR is more common in men, THIN, AFib, HF.

(ICSD), 3rd ed. 2014
C. PSG shows all of the following:

1. $\geq 5$ 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).

(ICSD), 3rd ed. 2014
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. \textit{mortality HF with CSR > without CSR.}
Periodic recurrent central apnea alternating with a crescendo-decrescendo pattern of tidal volume.

Crescendo-decrescendo with desaturation تنفس يزيد وينقص

apnea بعدين تجي

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 wakefullness to stage 1 sleep.
D.) Mixed Apnea

• Begins as central apnea followed by obstructive apnea

• Seen in patients with OSA

• Often found in Down’s Syndrome

CSR management: optimize cardiac function by medications > apnea might disappear. If apnea persists: CPAP with oxygen, or Adaptive servo ventilation.
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”
• Sleep Disordered Breathing is an important medical disorder that warrants active investigation by means of a clinical evaluation and polysomnographic sleep studies.

• 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.
• 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